

Samuel Neaman Institute
For National Policy Research



Technion
Israel Institute of Technology

Green Aviation – Literature Survey

Submitted to the Civil Aviation Authority

By Prof. Yehuda Hayuth, Orly Nathan and Ortal Faibushenko

Consultant: Prof. Ofira Ayalon

3 Infrastructural Research

December 2011

ABOUT THE SAMUEL NEAMAN INSTITUTE

The Samuel Neaman Institute was established in 1978 in the Technion at Mr. Samuel Neaman's initiative. It is an independent multi-disciplinary national policy research institute. The activity of the institute is focused on issues in science and technology, education, economy and industry, physical infrastructure and social development which determine Israel's national resilience.

Policy research and surveys are executed at the Samuel Neaman Institute and their conclusions and recommendations serve the decision makers at various levels. The policy research is conducted by the faculty and staff of the Technion and scientists from other institutions in Israel and abroad and specialist from the industry.

The research team is chosen according to their professional qualifications and life achievements. In many cases the research is conducted by cooperation with governmental offices and in some cases at the initiative of the Samuel Neaman institute and without direct participation of governmental offices.

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The chairman of Samuel Neaman Institute is professor Zehev Tadmor and the director is professor Moshe Moshe. The institute operates within the framework of a budget funded by Mr. Samuel Neaman in order to incorporate Israel's scientific technological economic and social advancement.

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אין לשכפל כל חלק מפרסום זה ללא רשות מראש ובכתב ממוסד שמואל נאמן מלבד לצורך ציטוט של קטעים קצרים במאמרי סקירה ופרסומים דומים תוך ציון מפורש של המקור.

הדעות והמסקנות המובאות בפרסום זה הן על דעת המחברים ואינן משקפות בהכרח את דעת מוסד שמואל נאמן.

Table of Contents

1. Introduction	4
2. Green Aviation – Policy	6
2.1 ICAO - International Aviation and Climate Change - Cancun Convention, December 2010	7
2.2 FAA - Environmental policy - Homepage	9
2.3 FAA - NextGen Project and the Environment	10
2.4 European Commission - Homepage of Transport-Air-Environment	12
2.5 European Commission - Climate Action: Homepage of Reducing Emissions from the Aviation Sector	13
2.6 European Commission: European Civil Aviation Handbook	16
2.7 European Commission: SESAR and Environment (Single European Sky ATM Research)	17
2.8 European Commission: AIRE (Atlantic Interoperability Initiative to Reduce Emissions)	18
2.9 TRB-Critical Issues in Aviation and the Environment, 2009	20
2.10 Enviro.aero – Clearer Vision, Cleaner Sky	24
3. Green Airports - Guidelines, Policy and Regulations	26
3.1 ACI-Europe - An Outlook for Europe's Airports: Facing the Challenge of the 21st Century	27
3.2 EUROCONTROL - Airport Environmental Partnership: A Guide Implementing Collaborative Environmental at Airports	30
3.3 FAA - National Environmental Policy Act (NEPA) Implementing Instructions for Airport Projects-Order 5050.4B	31
3.4 FAA - Environmental Desk Reference for Airport Actions	32
3.5 ACRP-TRB - Airport Sustainability Practices: A Synthesis of Airport Practice	33
3.6 Green Airport Initiative	35
4. Green Airports – Environmental Quality (Air, Soil and Water)	39
4.1 Airport Air Quality Guidance Manual	39
4.2 ACI-EUROPE - Airport Carbon Accreditation Annual Report 2009-2010	42
4.3 PARTNER - Aircraft Impacts on Local and Regional Air Quality in the United States - Final Report	44
4.4 Water Efficiency Opportunities: Airports - Best Practice Guide.	45
4.5 Sydney Airport Environment Strategy 2010 – 2015 - Water Management	46
4.6 Management of Airport Industrial Waste	46
5. Green Airports - Specific Airports	48
5.1 Dallas/Fort Worth International Airport - USA	48
5.2 Gatwick Airport - London	50
5.3 Narita Airport - Tokyo	53
5.4 Vancouver Airport - Canada	56
6. Wildlife Hazards	58
7. Coordination of Civilian-Military Air Traffic Management	61

8. Summary	62
9. Bibliography	67
9.1 Policy and Activities of Organizations Related to Green Aviation Research and Implementation	67
9.2 Climate Change and Emission Trading System	68
9.3 Wildlife	69
9.4 Green Airports – Guidelines, Policy and Regulations	69
9.5 Green Airports – Waste & Recycling	70
9.6 Green Airports – Water	70
9.7 Green Airports – Energy	70
9.8 Green Airports – Local Air	70
9.9 Green Airports – Noise	71
9.10 Green Airports – Diffusion of diseases	72
9.11 Green Airports - Projects of Specific Airports	72
9.12 Coordination of Civilian-Military Air Traffic Management	74
10. Abbreviations	75

הקדמה

מוסד שמואל נאמן למחקר מדיניות לאומית בטכניון מוציא לאור סידרת פרסומים המסכמת את המחקרים אשר בוצעו במסגרת פרויקט "אסטרטגיית פיתוח תשתיות לאומיות בישראל".

תשתיות מפותחות הינן תנאי הכרחי לקיומו של משק מודרני. תכנון אסטרטגי של פיתוח התשתיות הוא חיוני הן בשל פרקי הזמן הארוכים הכרוכים בתכנון, תהליך קבלת האישורים הנדרשים, במימון ובביצוע. במקביל קיים צורך בזהוי ושמירת אופציות לפיתוח ארוך טווח ושמירה על זכויות הדורות הבאים. עם זאת, בכדי להבטיח השגת היעדים שהוגדרו לטווח ארוך, יש לגזור מההמלצות מרכזיים מרכזיים אותם חובה ליישם כבר בטווחי הזמן הקצר והבינוני.

להבדיל ממרבית המדינות המפותחות בעולם, לישראל יש מספר מאפיינים המייחדים אותה ואשר להם זיקה ישירה לענפי התשתית. ישראל היא אחת המדינות המפותחות הבודדות שבהן אחוז הגידול של האוכלוסייה הוא גבוה יחסית. עובדה זו מציבה אתגר גדול הנובע מהצורך להגדיל ולהוסיף תשתיות ולא רק לשפר את התשתיות הקיימות. בנוסף, ישראל היא מדינה בעלת שטח פיזי קטן וצפיפות אוכלוסייה גבוהה יחסית. לפיתוח התשתיות יש לפיכך השפעה ישירה על איכות החיים ועל השמירה על ערכים סביבתיים.

הפרויקט מתרכז בהערכת הביקושים העתידיים לתשתיות פיזיות במדינת ישראל והיכולת להקים מערכות תשתית הולמות ובנות קיימא, העונות על הביקושים הצפויים. דגש נוסף בפרויקט ניתן לבחינת מערכת יחסי הגומלין בין מרכיבי התשתית השונים לבין עצמן ובין לבין המערכות הכלכליות, החברתיות והסביבתיות הרלוונטיות.

הפרסום הנוכחי נושא "תעופה ירוקה" – סקר ספרות. מטרת העבודה היא לבצע סקר מקורות אשר יאתר את הנושאים הרלוונטיים הקשורים, הנידונים והנחקרים בתחום המוגדר בספרות המקצועית ובמסמכים של הארגונים הרלוונטיים בעולם כ"תעופה ירוקה" ולסווג אותם לפי תחומים. לאחר מכן העבודה התרכזה והציגה את אותם נושאים העשויים להיות רלוונטיים למדינת ישראל ולטיפול של רשות התעופה האזרחית, אשר הזמינה את העבודה.

פרופ' יהודה חיות

מרכז הפרויקט ועורך הסידרה

1. Introduction

רשות התעופה האזרחית פנתה למוסד שמואל נאמן בטכניון בבקשה להכין סקר ספרות ראשוני בנושא "תעופה ירוקה".

מטרת העבודה:

- ביצוע סקר ספרות שיאתר את הנושאים הרלוונטיים הקשורים הנידונים והנחקרים בתחום המוגדר כ"תעופה ירוקה" ויסווג אותם על פי תחומים. יושם דגש להתפתחויות בעולם הקשורות לנושאים סביבתיים בתעופה.
- לאחר השלמת הסקר וניתוח הממצאים, יוצגו הנושאים העשויים להיות רלוונטיים למדינת ישראל ולטיפול רשות התעופה האזרחית.

הנושא הכללי הנכלל במסגרת ההגדרה של "התעופה הירוקה" מרכז סביבו בשנים האחרונות תשומת לב רבה. הדבר בא לידי ביטוי בכנסים בינלאומיים ואזוריים, בעבודות ובפרסומים רבים שמבוצעים על ידי קשת רחבה של מרכיבי ענף התעופה הכוללים בין השאר: ארגונים ומוסדות בינלאומיים העוסקים בתחום התעופה ואיכות הסביבה, גופים רגולטורים בנושא ברמת המדינות השונות, יצרני מטוסים, חברות תעופה, נמלי אוויר, גורמי מחקר, מוסדות וארגונים הקשורים לענף. בכינוס העולמי האחרון העוסק בנושא התחממות כדור הארץ שנערך בדצמבר 2010 ב-Cancun שבמקסיקו, נושא ה"תעופה הירוקה" היה אחד המרכזיים בדיון.

בשלב הראשון של העבודה נסרק מספר גדול של עבודות, מחקרים ופרסומים בקשת רחבה של תחומים הנכללים במסגרת ההגדרה של "Green Aviation". לאחר ניתוח החומר, נערך מיון שכלל ארבעה עשר נושאים מרכזיים:

נושאים נבחרים הנידונים בעולם בתחום התעופה הירוקה

- Alternative fuel
- Fuel efficiency
- Emission policy and EU Emissions Trading Scheme
- Aircraft noise
- Green airports
- Recyclable materials
- Eco-design
- Green regional aircraft
- Green rotor craft
- Sustainable and green engine
- Smart Fixed Wing Aircraft
- Environmental Management System
- Diffusion of diseases
- Danger of birds

לאור המגוון הגדול והתחום הרחב של הנושאים, נקבע בתאום עם נציגי רשות התעופה בישראל להתרכז במסגרת סקר הספרות הראשוני בנושאים בעלי רלוונטיות מיוחדת למדינת ישראל כדלקמן:

- מדיניות תעופה ירוקה בארצות נבחרות. הכוונה להעשיר את המידע על ההתייחסות הבינלאומית לנושא, עם דגש במיוחד על ארצות הברית, האיחוד האירופי וארגון ICAO. לאחר דיון, סוכם שנושא מדיניות ה"תעופה הירוקה" בישראל לא יכלל במסגרת הסקר וההתרכזות תהיה בהיבט הבינלאומי בלבד.
 - הטיפול בנושא תכנון, פיתוח, תפעול ואחזקה של מתקני שדות התעופה (Green Airports) והמדיניות הסביבתית בהם, יותר מכל נושא אחר, הם בשליטת הגורמים האחראיים במדינת ישראל. הנושאים אליהם קיימת התייחסות בסקר הספרות בתחום זה כוללים מגוון נושאים, בין השאר: איכות האוויר, רעש, אנרגיה, תחזוקה, הטיפול באשפה, מים ושפכים, ועוד. נושא המדיניות טופל בשלוש רמות שונות: בינלאומית (בעיקר בתחום גזי חממה), ברמה הלאומית וכן מוצגים מסמכים הנוגעים לרמת שדות תעופה ספציפיים באירופה, ארה"ב, קנדה ויפן.
 - השילוב האינטנסיבי בין תעופה אזרחית ותעופה צבאית - נושא בעל חשיבות מיוחדת בישראל. כמו כן, התייחסות לנושא הציפורים והסכנות לתעופה. בנושא הציפורים קיימת הפניה עדכנית. המסמכים בנושא השילוב בין התעופה האזרחית והתעופה הצבאית עוסקים, בעיקרם, בתיאום בתחום פיקוח אווירי, מסלולי טיסה ונושאים מבצעיים. בשלב זה לא נמצאה התייחסות לנושא איכות הסביבה במסגרת זו.
- בכל אחד מהנושאים לעיל הובאו תקצירים של מבחר מסמכים ומאמרים עדכניים המלווים במראי מקום ורשימה ביבליוגרפית של מקורות ואתרים המאפשרים הכרות רחבה יותר עם הנושאים הנדונים. למרות ההתרכזות בנושאים הרלוונטיים יותר לישראל, ראוי לציין שחלק ניכר מארבעה עשר התחומים המצוינים לעיל, זוכים להתייחסות במסגרת תקצירי המאמרים והביבליוגרפיה שמציגה העבודה.
- נושא "התעופה הירוקה" הוא דינמי מאוד. חלק מהפרסומים חוזר ומופיע על בסיס שנתי. לפיכך עם הופעת פרסום מעודכן, נמחק לעיתים העותק הקודם. יש אם כן להקפיד לקרוא את הגרסה המעודכנת. בעבודה זו נכללו כבר תקצירים של פרסומים שיצאו לאור כבר ב-2011 והחליפו גרסאות משנה קודמת (שהיו חלק מהטיוטה הקודמת של העבודה).

2. Green Aviation – Policy

הפרק כולל התייחסות לנושאים של מדיניות תעופה ירוקה ברמה גלובלית (ICAO) וברמה האזורית (ארה"ב והאיחוד האירופי). נושא איכות הסביבה משולב בדיוני ICAO במסגרת התייחסות הכוללת לנושא **שינוי האקלים**. העיסוק בנושא עלה מדרגה בחשיבותו במסגרת הכינוס האחרון של האו"ם בנערך בקונן בדצמבר, 2010. בכנס זה הועלה נושא זיהום האוויר ופליטת גזי חממה בשני אמצעי הובלה מרכזיים - התעופה והספנות. במסמך 2.1 מפורטת מדיניות עולמית של 190 מדינות חברות להפחתה של פליטת גזי חממה בתעופה. בין הנקודות העיקריות, סוכם שרמת פליטת CO2 תישאר ברמתה הנוכחית עד 2020, למרות הגידול המשמעותי בהיקף הפעילות בענף התעופה, כמו כן נקבע יעד לשיפור של יעילות צריכת הדלק בשני אחוזים לשנה עד 2050.

בדף הבית של ארגון FAA בנושא הסביבה (מסמך 2.2), מפורטת רשימת הנושאים הכלולים במסגרת המדיניות כמו פליטות ממנועי המטוסים, רעש ואיכות האוויר. בהמשך מופיעות שתי הפניות (מסמך 2.3) של מיזם "הדור הבא" – דף הבית נותן מבט תמציתי על מדיניות התוכנית של מערכת התעופה בארה"ב המאפשרת פיתוח תעופה בת קיימא, תוך הקפדה על בטיחות הטיסה ויעילותה. שלושת היעדים המרכזיים בתוכנית זו ל-2018 הם: הפחתה מצטברת של CO2 של 14 מיליון טון, הורדה של 1.4 מיליארד גלון של דלק וצמצום העיכובים בטיסות בהיקף של 21 אחוז.

נושא התעופה והסביבה נידון בהרחבה באיחוד האירופי. חמישה מסמכים והפניות מציגים את מרכיבי המדיניות. של האיחוד האירופי בתחומים של תחבורה, הפיכת אירופה לשמיים פתוחים, שינוי אקלים והפחתת פליטות לצד היבטים מחקריים וטכנולוגיים. מסמך 2.4 המתעדכן לעיתים קרובות, מפרט את התפיסה הכללית של מדיניות תעופה וסביבה באיחוד האירופי. הדיון מתמקד בשני נושאים מרכזיים: רעש הנגרם על ידי מטוסים ופליטת גזי חממה. הנושא הראשון מתרכז בעיקר סביב שדות התעופה ולנושא השני יש השלכות מקומיות על איכות האוויר ובמקביל גם השפעות גלובליות בתחום שינויי האקלים. נושאים אלה הופכים יותר ויותר משמעותיים ככל שהיקף הפעילות האווירית הולך וגדל. ההערכה היא כי פעילות התעופה אחראית ל-2-3 אחוזים מסך כל הפליטות של CO2 והתחזית היא שמרכיב זה יעלה ל-4 אחוז ב-2050. היקף התעופה באירופה צפוי לגדול במהלך השנים הבאות בקצב של 4-5 אחוז בשנה והיקף פליטות גזי חממה ימשיך לעלות למרות השיפורים הטכנולוגיים כמו הפחתת שריפת הדלק לנוסע. לצורך התמודדות עם הבעיה מתמקדת מדיניות האיחוד בשלושה כיוונים: מחקר ופיתוח של "טכנולוגיה ירוקה" במסגרת התוכנית השביעית במטרה להפחית פליטת של CO2 ו-NOX, פיתוח מערכות מודרניות של ניהול תעופה ובמיוחד קביעת רפורמה של שמיים אירופיים פתוחים (SES ויוזמת SESAR). הכיוון השלישי הוא נקיטת אמצעים המבוססים על מבוססים על ETS (תוכנית המסחר בפליטות גזי חממה) המפורט במסמך 2.5.

מסמך 2.6, מציג את המדריך לתעופה האזרחית. עם ההיווצרות של שוק תעופה אחד במסגרת האיחוד האירופי, מתפתחת המסגרת הרגולטורית. על מנת להנגיש את החוקים ולהקל על הקריאה בהם, פותח המדריך לתעופה האזרחית הכולל שלושה חלקים: החלק הראשון עוסק ברגולציות והוראות; החלק השני עוסק בהחלטות, מקרים משפטיים וחוקים תחרותיים; החלק השלישי מאגד הסכמים בינלאומיים.

מסמך 2.7 מציג את פרויקט המחקר SESAR (Single European Sky ATM Research) בהיבטים הסביבתיים של ניהול התעבורה האווירית. המדיניות הסביבתית של SESAR היא לצמצם את ההשלכות הסביבתיות בעשרה אחוז לכל טיסה בלי לפגוע בבטיחות וביעילות הכלכלית. היעדים של התוכנית נחלקים לטווחים קצרים (2009-2011) ולטווחים ארוכים יותר עד 2020 ועיקרם: שיפור תפקיד ניהול מערכות התעופה בפיתוח תקנות סביבתיות ואכיפתן ברמה האירופית בנושא רעש ופליטות גזים.

מסמך 2.8 מציג את פרויקט AIRE (Atlantic Interoperability Initiative to Reduce Emissions), פועל יוצא משיתוף פעולה של הנציבות האירופית וה-FAA לשם תיאום בין שתי תוכניות, שיעדן שיפור הפיקוח והמודרניזציה של התעבורה האווירית: SESAR ו-NEXTGEN באירופה ובארה"ב. התיאומים הללו כוללים, בין השאר, את נושאי ההסעה על המסלולים, שדות התעופה, טיסות טרנס-אטלנטיות וצוואר הבקבוק שנוצר בשדות התעופה. ב-2009 בוצעו יותר מאלף טיסות בהשתתפות חברות תעופה ושדות תעופה.

מסמך 2.9 שנערך על ידי ה-TRB מציג נושאים קריטיים נוספים מעבר לנושא הרעש ופליטת גזי חממה כמו דלק חלופי, קיימות, פיתוח טכנולוגי, צריכת אנרגיה, פליטות בשדות התעופה ומודלים של מחקר בתחום הסביבה.

נקודת מבט נוספת שראויה להתייחסות היא מדיניות המשתתפים החשובים של תעשיית התעופה העולמית כמו יצרניות המטוסים והמנועים בנושא פיתוח תעופה בת קיימא והיא מוצגת במסמך 2.10.

הפניות למסמכים נוספים בנושאים אלה ניתן למצוא ברשימה הביבליוגרפית בפרק 7.

2.1 ICAO - International Aviation and Climate Change - Cancun Convention, December 2010

International Civil Aviation Organization (2010).

2.1A Statement from the International Civil Aviation Organization (ICAO) to the Thirty-third Session of the UNFCCC Subsidiary Body for Scientific and Technological Advice (SBSTA33), 30 November to 4 December 2010 – Cancun, Mexico.

<http://www.icao.int/icao/en/env2010/Statements/sbsta-33.pdf>

2.1B UNITED NATIONS FRAMEWORK CONVENTION ON CLIMATE CHANGE (UNFCCC)

The thirty-third Session of the UNFCCC Subsidiary Body for Scientific and Technological Advice (SBSTA33) (30 November to 4 December 2010 – Cancun, Mexico)

Agenda Item 6 (a): Emissions from fuel used for international aviation and maritime transport

ASSEMBLY RESOLUTION ON INTERNATIONAL AVIATION AND CLIMATE CHANGE (Submission by the International Civil Aviation Organization (ICAO), as part of FCCC/SBSTA/2010/MISC.14)

ASSEMBLY RESOLUTION ON INTERNATIONAL AVIATION AND CLIMATE CHANGE (A37-19)

http://www.icao.int/env/Statements/sbsta-33_Item-6a.pdf

1.1 The 37th Session of the International Civil Aviation Organization (ICAO) Assembly that took place from 28 September to 8 October 2010 adopted Resolution A37-19: Consolidated statement of continuing ICAO policies and practices related to environmental protection – Climate change. The full text of the Resolution is included in Appendix A.

1.2 ICAO was able to bring its 190 member States together and adopted a comprehensive, robust and global policy on how to address GHG emissions from international aviation. Assembly Resolution A37-19 reflects the determination of ICAO's member States to continue to play a leading role in the global efforts to address climate change by working through ICAO to limit or reduce GHG emissions from international aviation. High-level Meeting and Alternative Fuels Conference in 2009, and goes one step further by incorporating the following key elements:

1. Further endorsement of the global aspirational goal of 2 per cent annual fuel efficiency improvement up to year 2050;

2. A medium term global aspirational goal from 2020 that would ensure that while the international aviation sector continues to grow, its global CO₂ emissions would be stabilized at 2020 levels;
3. Further work to explore the feasibility of a long-term global aspirational goal for international aviation;
4. Development of a framework for market-based measures, including further elaboration of the guiding principles adopted by the Assembly, and exploration of a global scheme for international aviation;
5. Concrete steps to assist States to contribute to the global efforts;
6. de minimis provisions to ensure that States with small contributions to the global airtraffic are not burdened disproportionately; and
7. States' action plans, covering information on CO₂ emissions reduction activities and assistance needs.

1.3 The Resolution makes ICAO the first UN specialized agency to establish a globally harmonized agreement as a sector for limiting its CO₂ emissions. These elements, together with further work by the Council and States, including the development and deployment of sustainable alternative fuels for aviation and the provision of guidance and other technical assistance for the preparation of States' action plans, comprise an ambitious work programme over the next triennium and beyond, to move towards the sustainable future of international aviation.

1.4 The Assembly also decided that the Council should undertake further work in order to make progress on a number of issues contained in Resolution A37-19, where States expressed concerns, such as the implementation of the medium term global aspirational goal and market-based measures including the de minimis provision.

1.5 In addition, the ICAO's Committee on Aviation Environmental Protection (CAEP) is expected to develop a global CO₂ Standard for aircraft aiming for 2013, while the Secretariat has already started planning regional workshops that aim to assist States to prepare their action plans and submit them to ICAO by the end of June 2012.

2. High-level advisory group on climate change financing (AGF)

2.1 As part of the on-going work within the UN system on climate change, a High-level Advisory Group on Climate Change Financing (AGF) has been studying the contribution of potential sources of revenue to meet the goal of mobilizing USD 100 billion a year by 2020. One of the options considered by the AGF relates to the potential revenue from the international aviation sector. ICAO submitted its comments to the AGF process, focusing on political, legal and practical implications that the AGF's work would have for existing ICAO's policies and practices related to international aviation and climate change, including the need to ensure consistency with Resolution A37-19 adopted by the ICAO Assembly.

2.2 The international aviation sector should not be singled out as a source of revenues for all other sectors. This is likely to result in a shortage of resources to facilitate mitigation activities by the international aviation sector itself, and in a disproportionate contribution of resources from this sector as compared to other economic sectors.

Furthermore, such action could hinder further progress of the globally-harmonized agreement that was adopted by the ICAO Assembly.

2.3 It should be noted that the ICAO Assembly adopted the guiding principles for design and implementation of market-based measures for international aviation. One of the principles clearly stipulates that “market-based measures should ensure the fair treatment of the international aviation sector in relation to other sectors”. The Assembly also “strongly recommended that, where revenues are generated from market-based measures, they should be applied in the first instance to mitigating the environmental impact of aircraft engine emissions”. In this context, any market-based measure involving international aviation should be designed to mitigate the impact of international aviation GHG emissions aimed at achieving the global goals of the sector.

3. Conclusions

3.1 As a specialized UN agency responsible for international aviation matters, ICAO has been working actively towards developing a global solution to address GHG emissions from international aviation. The ICAO Assembly Resolution A37-19 is a clear demonstration of the willingness of ICAO and its member States to take concrete steps towards addressing CO₂ emissions from international aviation. It represents a big challenge, but provides an array of opportunities as ICAO moves forward in demonstrating to the world how it intends to achieve the ultimate objective of environmentally sustainable international aviation.

3.2 ICAO will continue to exercise its leadership in all matters related to international aviation, including the limitation or reduction of GHG emissions, which shall be addressed under the globally harmonized framework outlined in Resolution A37-19, with all member States and the air transport industry working further through ICAO.

2.2 FAA - Environmental policy - Homepage

Federal Aviation Administration (2010).

http://www.faa.gov/regulations_policies/policy_guidance/envir_policy/

- Aircraft Contrails Fact Sheet
- Aircraft Engine Emissions
- Airport Noise and Compatibility Planning
- Air Quality Handbook
- Aviation Climate Change Research Initiative (ACCRI)
- Aviation & Emissions, A Primer
- Aviation Noise Abatement Policy
- Comprehensive Procurement Guideline (CPG) Update: Recycled Content Products — Biobased Products
- Consideration of Air Quality Impacts by Airplane Operations at or Above 3000 ft
- Environmental Management Systems and NEPA Adaptive Management
- FAA and EPA Recommended Best Practice for Quantifying Speciated Organic Gas Emissions from Aircraft Equipped with Turbofan, Turbojet, and Turboprop Engines (May 2009)
 - Recommended Best Practice Document Version 1.0 (May 27, 2009)

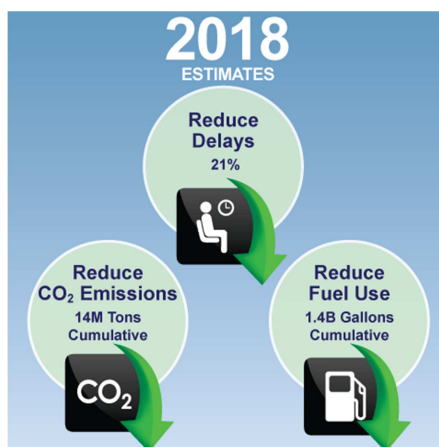
- Quality Assurance Project Plan
- Fuel Venting and Exhaust Emission Requirements for Turbine Engine Powered Airplanes
 - Advisory Circular 34-1B
- Guidance for Quantifying Speciated Organic Gas Emissions from Airport Sources
- Information on Reducing Emissions from Ground Support Equipment GSE and Auxiliary Power Units APUs
- IPCC Special Report: Aviation and the Global Atmosphere
- Report to Congress: Nonmilitary Helicopter Urban Noise Study
- Workshop on the Impacts of Aviation on Climate Change - A Report of Findings and Recommendations (August 2006) -Full Report of Findings and Recommendations

2.3 FAA - NextGen Project and the Environment

Federal Aviation Administration (2010).

2.3A FAA - NextGen Project and the Environment - Home Page

<http://www.faa.gov/nextgen/benefits/environment/>



2.3 B. NextGen Implementation Plan 2010

http://www.faa.gov/nextgen/media/NGIP_3-2010.pdf

The NextGen vision is to provide environmental protection that allows sustained aviation growth. Environmental management is increasingly complex, particularly with mounting domestic and international pressure to address climate change and reduce greenhouse gas emissions, and the associated scientific uncertainties. If not properly addressed, environmental impacts could constrain the industry in the future. Our challenge is to reduce aviation's environmental footprint, even with projected growth in air travel.

The FAA takes a comprehensive, five-pillar approach to mitigate aviation's environmental impact and address related energy issues: advances in science and modeling; operational improvements; new technologies; renewable fuels; and policy initiatives including the environmental management system (EMS).

NextGen will increase the efficiency of aircraft operations, both in the air and on the airport surface. Improving efficiency saves time and fuel. When we reduce fuel consumption, we reduce carbon dioxide and other emissions that contribute to poor air quality.

While operational benefits offer environmental performance improvements, the net system-wide effect can be offset by increased growth. Additional measures are needed, and we are aggressively pursuing these measures under NextGen.

Historically most reductions in aviation's noise and emissions impacts have come from new technologies. Our vision is for a fleet of quieter, cleaner aircraft that operate more efficiently with less energy. Solutions that involve improvements in aircraft engines and airframes in a foreseeable time frame require successful maturation and certification of new technologies within five to eight years. The Continuous Lower Energy, Emissions and Noise (CLEEN) program has been established to mature and accelerate promising new technologies into the civil fleet.

The development and deployment of sustainable alternative fuels offer prospects for aviation environmental improvements, energy security and economic stability. Breakthroughs in sustainable alternative fuels are needed in addition to operational improvements and engine/airframe technological advances to offset emissions from aviation growth. The FAA works with government and industry partners under the auspices of the Commercial Aviation Alternative Fuels Initiative (CAAIFI) to support sustainable alternative jet fuels.

We also are analyzing policy and market-based measures, including cap-and-trade proposals. EMS is a key to integrate environmental protection objectives into NextGen planning and operations. EMS provides a structured approach for managing environmental responsibilities to improve environmental performance and stewardship. All five pillars of the FAA's approach to sustainability are needed to address the environmental and related energy pressures facing the aviation industry.

Like other sectors of the economy, aviation will be called on to contribute its share in reducing man-made contributions to climate change. The FAA is leading U.S. efforts at the International Civil Aviation Organization (ICAO) to limit and reduce international aviation emissions. In 2009, ICAO adopted the first global approach to carbon emissions for any industry. It consists of a global, aspirational goal of 2 percent annual fuel efficiency improvement from 2009 to 2050, a basket of measures from which nations can choose to contribute to the global goal, a requirement that all nations report traffic and fuel burn data to ICAO in order to monitor progress, and development of a global carbon emissions standard for aircraft. ICAO has agreed to explore more ambitious goals for aviation, such as carbon-neutral growth in the mid-term and reductions in the long-term, for consideration at the ICAO Assembly in September 2010.

Financially pressed airlines face difficult decisions on when and how to invest in new equipment and newer generations of aircraft. As national and international frameworks for limiting carbon emissions become clearer and more definitive, and other emissions and noise reduction pressures remain strong, the business case for NextGen investments is all the more favorable.

Here are some of the ways the FAA addressed environmental challenges in 2009:

- We established the CLEEN program to mature and accelerate clean and quiet technologies and fuels. NASA's Environmentally Responsible Aviation project and CLEEN are guiding coordinated efforts to mature new technologies that reduce fuel burn, emissions and noise.
- We worked with government and industry partners in CAAFI to achieve approval of the first alternative-fuels specification. It allows use of up to 50-percent blends of Fisher-Tropsch processed fuels with conventional Jet A fuel. The specification opens the way for potential suppliers to market alternative fuels to the commercial aviation sector. In 2010, CAAFI will work with ASTM (American Society for Testing of Materials) International, a standards development organization, to gain approval for 50-percent blends of Hydrotreated Renewable Jet fuel, which may offer greater carbon reductions.
- We began implementing recommendations from the Aviation Climate Change Research Initiative to research effects of non-carbon-dioxide emissions on the Earth's climate. NASA, the Environmental Protection Agency, the National Oceanic and Atmospheric Administration and others support this work. We continued developing an advanced integrated noise and emissions modeling capability to find more effective approaches to mitigate overall impacts.

2.4 European Commission - Homepage of Transport-Air-Environment

European Commission (2010)

http://ec.europa.eu/transport/air/environment/environment_en.htm#top

The main environmental effects of aviation are those of aircraft noise and aircraft emissions. The former largely affect areas at and around airports, the latter can have both local effects on air quality and global effects on climate. These problems are becoming more serious as aviation continues to grow at rates that outstrip the ability of technological and operational improvements in environmental performance to keep pace.

Is civil aviation a major CO2 problem?

The aviation impact on climate change mainly stems from CO₂, NO_x and contrails and cirrus clouds. CO₂ emissions are by far largest. Aviation is estimated to account for 2(-3)% of CO₂ emissions and forecasts estimates that it will be around 4% in 2050.

Therefore, aviation cannot be considered as a major contributor to climate change but aviation shall also reduce its impact on climate change.

Aviation is expected grow 4-5% per year in Europe over the next years with a doubling of traffic around 2020. This means that emissions from aviation are growing despite the reductions in emissions per flight due to technological progress (where for instance fuel burn per passenger seat has been reduced by 70% over 40 years).

A comprehensive approach is therefore needed. The EU is pursuing three streams, namely 1) R&D for 'greener' technology, 2) modernised air traffic management systems and 3) market based measures.

1. High priority is given to "the greening of air transport" in the 7th Framework Programme for research and technology development. The flagship will be the "Clean Sky" Joint Technology Initiative. By 2020 the aim is to reduce fuel consumption and hence CO₂ emissions by 50% per passenger kilometre, to reduce NO_x emissions by 80% (in landing and take-off according to ICAO standards) and to reduce unburnt hydrocarbons and CO emissions by 50%. (it also aims at significant noise reductions)
2. The Single European Sky (SES) legislation reforms the way air traffic management is organised in Europe. This requires a modernisation of the air traffic management systems in Europe. The SESAR initiative is the technological component of SES and one of the objectives is to reduce emissions by 10% per flight.
3. The Commission has made a proposal to include aviation in the EU emissions trading scheme (ETS), which is in line with ICAO's resolution (A35-5) in incorporating international aviation into existing trading schemes. The main burden will be on EU airlines. The overall impact on the industry is marginal. The timing in the EU decision making process will allow considering the outcome of ICAO's discussions at the assembly in September 2007. In 2008 the Commission will come with a proposal regarding NO_x emissions.

The three streams should be followed simultaneously as they complement each other.

Other actions are taken in addition to the three main streams just mentioned. The Commission has for instance just published a call for tender for a feasibility study regarding the use of renewable energy sources, in particular biofuels, in aviation.

The EU believes that ICAO should promote an approach following all three streams simultaneously and that ICAO should pursue this pro-actively and take leadership to find a global solution as soon as possible.

Air Quality Concern is focused on the potential health and environmental effects of air pollution from emissions such as oxides of nitrogen (NO_x), volatile organic compounds and particulates. ICAO technical design standards limit emissions of NO_x, carbon monoxide (CO) and unburned hydrocarbons (HFC) at source. Although there is no specific EU legislation in relation to aviation emissions, the general EU legislation establishing limit values for the pollutants of concern (mainly NO_x and particulates in the case of aircraft emissions) apply at and around airports just as they do everywhere else in the EU

2.5 European Commission - Climate Action: Homepage of Reducing Emissions from the Aviation Sector

European Commission-Climate Action (2011).

http://ec.europa.eu/clima/policies/transport/aviation/index_en.htm

Policy

As air travel becomes cheaper, EU emissions from aviation are increasing fast. Someone flying from London to New York and back generates roughly the same level of emissions

as the average person in the EU does by heating their home for a whole year. In order to mitigate the climate impacts of aviation, the EU has decided to impose a cap on CO₂ emissions from all international flights – from or to anywhere in the world – that arrive at or depart from an EU airport.

After undertaking a wide-ranging consultation of stakeholders and the public and analysing several types of market-based solutions, the Commission concluded that bringing aviation into the EU Emissions Trading System (EU ETS) would be the most cost-efficient and environmentally effective option for controlling aviation emissions.

Compared with alternatives such as a fuel tax, bringing aviation into the EU ETS will provide the same environmental benefit at a lower cost to society - or a higher environmental benefit for the same cost. In other words the impact on ticket prices, airline companies and the overall economy will be smaller for a given environmental improvement.

How will the trading in aviation emissions work?

The EU Emissions Trading System, which started on 1 January 2005, covered in the past only energy-intensive industrial installations – more than 10,000 of them across Europe, which are collectively responsible for nearly half of total EU CO₂ emissions. Since the EU legislation adopted in 2009, air operators will also be covered.

Like industrial installations, airlines will receive tradeable allowances covering a certain level of CO₂ emissions from their flights per year. After each year operators must surrender a number of allowances equal to their actual emissions in that year.

Selling, "banking" and buying allowances

The existence of a market in which these allowances can be traded enables operators to manage their emissions cost-effectively.

If their actual emissions are lower than their allowances, they can sell their surplus allowances on the market or else 'bank' them to cover future emissions.

If they anticipate that their emissions will exceed their allowances, they can either take measures to reduce their emissions - for instance by investing in more efficient technologies or operational practices - or they can buy additional emission allowances on the market, whichever is cheaper. Thus, for example, airlines may be able to buy allowances from industrial installations that have reduced their emissions.

In addition, to help meet their obligations under the EU ETS, operators can also buy emission credits from clean energy projects carried out in third countries under the Kyoto Protocol mechanisms.

Inclusion of aviation into the EU ETS as of 2012

From the start of 2012, emissions from all domestic and international flights – from or to anywhere in the world – that arrive at or depart from an EU airport will be covered by the EU Emissions Trading System.

The intention is for the EU ETS to serve as a model for other countries considering similar national or regional schemes, and to link these to the EU scheme over time. Therefore, the EU ETS can form the basis for wider, global action.

Implementing legislation

- Commission Regulation No. 82/2010 on the list of aircraft operators specifying the administering Member State (28 January 2010)
- Commission Decision 2009/450/EC on the detailed interpretation of the aviation activities listed in the Annex I to Directive 2003/87/EC (8 June 2009)
- Commission Decision 2009/339/EC on the inclusion of monitoring and reporting guidelines for emissions and tonne-kilometre data from aviation activities (16 April 2009)

Process for the inclusion of aviation in the EU Emissions Trading System

- Directive 2008/101/EC of the European Parliament and of the Council amending Directive 2003/87/EC so as to include aviation activities in the scheme for greenhouse gas emission allowance trading within the Community (19 November 2008)
- Communication on the European Parliament's amendments to the Council's Common Position (19 September 2008)
- Resolution of the European Parliament on the Council common position on the Commission's proposal (8 July 2008)
- Communication of the European Commission on the Council's common position (22 April 2008)
- Common Position of the Council on the proposal (18 April 2008)
- Political agreement reached by the Environment Ministers on the Council's first reading position on the Commission's proposal (20 December 2007)
- First reading position of the European Parliament on the Commission's proposal (13 November 2007)
- Opinion of the Committee of the Regions stating it agrees with the Commission that aviation should be included in the ETS (10 October 2007)
- Council Conclusions on the position to be taken by EU Member States at the ICAO Assembly in September 2007 in relation to the inclusion of aviation in the EU Emissions Trading System (8 June 2007)
- Opinion of the European Economic and Social Committee welcoming the Commission's proposal as a "carefully considered and pragmatic approach" to address emissions from aviation (31 May 2007)
- Proposal for a Directive of the European Parliament and of the Council amending Directive 2003/87/EC so as to include aviation activities in the scheme for greenhouse gas emission allowance trading within the Community (20 December 2006)
- Resolution of the European Parliament in response to the Commission's Communication (4 July 2006)
- Opinion of the European Economic and Social Committee on the Commission's Communication (April 2006)
- Supportive conclusions of the Environment Council (December 2005)
- European Council conclusions (15/16 December 2005)
- Communication of the European Commission outlining plans to reduce the impact of aviation on climate change (27 September 2005)
- Directive 2003/87/EC of the European Parliament and of the Council establishing a scheme for greenhouse gas emission allowance trading within the Community and amending Council Directive 96/61/EC (13 October 2003)

Working groups

- Final report of the Aviation working group bringing together experts from Member States and industry, consumer and environmental organisations] (April 2006)
- Background documents and minutes from working group meetings

Other useful documents

- Preliminary impact assessment] (27 September 2005)
- Study on the possibility of including aviation in the EU Emissions Trading System (July 2005)
- Report on the public consultation on Reducing the Climate Change Impact of Aviation from 11 March until 6 May 2005
- Summary Impact Assessment
- Full impact assessment

2.6 European Commission: European Civil Aviation Handbook

http://ec.europa.eu/transport/air/handbook/handbook_en.htm

With the creation of a single aviation market within the European Union, the regulatory framework is constantly evolving in the light of new developments in this important sector.

In order to facilitate access to the legislation in force and ease its reading, a European Civil Aviation handbook has been developed.

This handbook is for information only, it does not have legal value, nor affect the legislation currently in force.

The present document amalgamates texts referring to the Community aviation policy into an “informative” Civil Aviation Handbook that can be used in parallel to the existing legislation. This handbook should be seen as a trial for improving the accessibility to the constantly growing aviation legislation. One outcome expected from this initiative is a more homogeneous interpretation of the EU acts.

This Civil Aviation Handbook is more than a simple collection of texts: acts are consolidated, recitals are removed, obsolete provisions are underlined, what is not in force any more is put aside, texts of differing nature dealing with a common subject are brought together... In other words, most obstacles hindering the aviation stakeholders from having a good knowledge of the legislation are removed.

In order to preserve the Handbook’s readability while trying to cover the maximum number of texts, texts of “horizontal nature” or “too technical” are not reproduced here but can be accessed by consulting the “Other related texts” page available every time such texts exist. On these pages the texts are listed and a hyperlink is provided for each act.

Other texts are not integrated into this handbook because they are either obsolete, repealed or due for repeal.

As a consequence the present handbook does not include all the texts cited under Air Transport on the EUR-Lex website. Another noticeable difference lies with the structure of the handbook.

Texts have been organised into three different parts.

Part I concerns regulations and directives.

Part II deals with decisions and case law as well as competition rules.

Part III collects the international agreements.

2.7 European Commission: SESAR and Environment (Single European Sky ATM Research)

SESAR Joint Undertaking (2010).

<http://www.sesarju.eu/environment/sesar>

Air traffic management affects when, how far, how high, how fast and how efficiently aircraft fly. These parameters in turn influence how much fuel an aircraft burns, the release of greenhouse and other gases from the engines and, of course, how much noise an aircraft emanates.

Currently, flight paths often follow set air corridors that make the route longer than necessary. On arrival at the destination the aircraft may have to circle in a holding pattern or descend in stages while awaiting a landing slot. All of these factors increase fuel consumption, pollution and greenhouse gas emissions. SESAR technology will enable more direct flight paths and smooth descent and climb that will eliminate some of the main causes of avoidable waste.

Within the SESAR programme most out of the almost 300 projects include environmental aspects of aviation. They concern aircraft noise management and mitigation, aircraft fuel use and emissions management, as well as water pollution, etc. But environmental aspects are dealt with in all of the 16 work packages. The Joint Undertaking's role is to establish environmental sustainability as an integral aspect of broader ATM development and operating processes.

SESAR's environmental policy: SESAR aims at reducing the environmental impact per flight by 10% without compromising on safety but with clear capacity and cost efficiency targets in mind. Embedded in the European Union's Single European Sky programme, SESAR will contribute to sustainable air transport within, into, out and over Europe. The programme unites all aviation players and such secures an effective deployment of the green technological and operational improvements.

Environmental goals 2009-2011 and beyond: The aim of the SESAR Joint Undertaking is to become the most environmentally conscious ATM development programme in the world. To this end, the SESAR programme will implement an advanced validation methodology that will ensure end-to-end consideration of environmental aspects in all R&D activities. At the same time, SESAR is in close cooperation with other European and international initiatives regarding the integration of new, environmentally friendly solutions for the aviation sector.

One such project is the European Union's Clean Sky Joint Technology Initiative that will develop breakthrough technologies to significantly improve the impact of the air transport on the environment. But SESAR also looks beyond 2011. Its long-term objectives are to:

- **Achieve emission improvements** through the optimisation of air traffic management services. The SESAR target for 2020 is to enable 10% fuel savings per flight as a result of ATM improvements alone, leading to a 10% reduction of CO₂ emissions per flight;
- **Improve the management of noise emissions and their impacts** through better flight paths, or optimised climb and descent solutions;
- **Improve the role of ATM in enforcing local environmental rules** by ensuring that flight operations fully comply with aircraft type restrictions, night movement bans, noise routes, noise quotas, etc.;
- **Improve the role of ATM in developing environmental rules** by assessing the ecological impact of ATM constraints, and, following this assessment, adopting the best alternative solutions from a European sustainability perspective.

Environmental management system: The aim of an environmental management system is to support the implementation of the ATM Master Plan seen from an environmental perspective. Such a system usually includes set performance targets, their monitoring, documentation, verification and auditing. Within the SESAR programme, the development of an environmental management system applicable to relevant ATM stakeholders which follows international standards (e.g. ISO14001/EMASII) is foreseen.

2.8 European Commission: AIRE (Atlantic Interoperability Initiative to Reduce Emissions)

2.7A European Commission - Homepage of Transport-Air-Environment-AIRE

http://ec.europa.eu/transport/air/environment/aire_en.htm

2.7B Delivering green results: A summary of European AIRE project results in 2009. SESAR Joint Undertaking and AIRE (2010).

http://ec.europa.eu/transport/air/environment/doc/aire_executive_summary_layouted_web.pdf

The joint initiative AIRE (Atlantic Interoperability Initiative to Reduce Emissions) fits in with the cooperation protocol signed by the Commission and the FAA to coordinate two major programmes on air traffic control infrastructure modernisation, SESAR in Europe and NEXTGEN in the United States.

The aim of AIRE is to capitalise on present aircraft technologies and to enhance operational procedures which have a direct impact in the short and medium term on greenhouse gas emissions.

Under this initiative ATM stakeholders work collaboratively to validate solutions for the reduction of CO₂ emissions for all phases of flight.

AIRE presently comprises on the European side alone, 18 projects involving 40 airline, airport, air navigation service provider and industry partners. Seven of the 18 project focus directly on complete green flights (i.e. gate-to-gate, instead of on a particular phase of flight), among others between France and the French West Indies. One highlight of the programme will be a series of green transatlantic flights with the Airbus A380, the world's largest airliner. In 2009, the European AIRE projects already conducted more than 1,000 flight trials in real conditions with 18 partners. As a result, many of the tested green procedures have already been implemented into 'day-to-day operations'.

For the Commission, the air transport sustainable development strategy is based on a consistent three-pillared approach:

1. Modernise the air traffic management system, by means of SESAR or more generally the Single European Sky and environmental initiatives such as AIRE;
2. Reduce the environmental performance of aircraft, through programmes such as Clean Sky or studies on the use of biofuels;
3. Economic mechanisms for trading emission rights, provide incentives for greener operations.

AIRE is the first large-scale environmental initiative bringing together aviation players from both sides of the Atlantic.

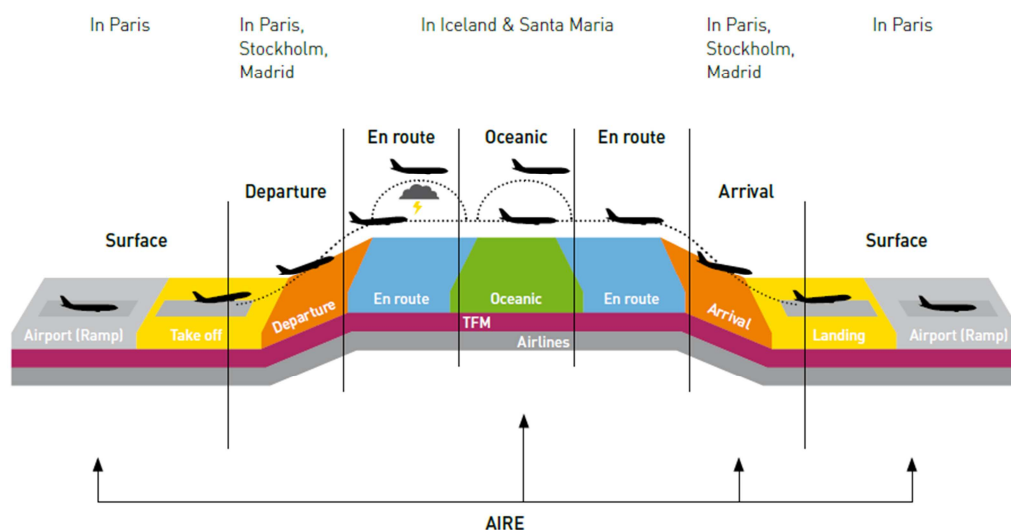


Illustration of AIRE domains during 2009

2009 trial flights: an introduction. In 2009, about 1152 demonstration trials took place in five locations involving 18 partners: Air France, DSNA, Aéroports de Paris, ADACEL, AVTECH, Egis Avia, Nav Portugal, TAP Portugal, Isavia, Iceland air, TERN Systems, AENA, INECO, Iberia, LFV, Novair, Airbus and Thales. The trials included surface as well as terminal and oceanic green procedures.

Ground movement: On average, aircraft are responsible for only about half of the emissions produced at and around airports. The airport related emission sources are generally categorised under aircraft emissions (aircraft engines and auxiliary power units), aircraft handling emissions (mainly ground support equipment, airside traffic, aircraft de-icing and refuelling), infrastructure or stationary sources (surface de-icing,

power/heat generation plant, construction activities, etc.), and all vehicle traffic sources associated with the airport on access roads.

In 2009, green ground movement trials performed at Paris CDG (Charles de Gaulle) demonstrated the effectiveness of a new collaborative decision support system which minimises taxi time and allows for reduced engine taxi operation.

Terminal: Airports are one of the bottlenecks of the current air traffic management system. Air traffic flows are managed on a first-come, first-served basis leading to unnecessary fuel burn, as air traffic control (ATC) often requires aircraft to level off and hold at intermediate altitudes during descent. 'Green' approach (such as Continuous Descent Approaches - CDA) or green climb trials at Madrid, Paris and Stockholm airports were conducted. The first 'Required Navigation Performance' (RNP) – based CDA approach ever to be performed in Europe was conducted at Stockholm's Arlanda airport.

Oceanic: In the current system, ever increasing traffic flows between Europe and North America are leading to inefficient fuel consumption, fewer accepted airline requests and schedule disruptions. Trials for "green" oceanic procedures and techniques (speed, horizontal and lateral flight profile optimisation) on selected routes between Europe and North/Central America and the Caribbean's were carried out.

2.9 TRB-Critical Issues in Aviation and the Environment, 2009

Transportation research circular E-C138. Transportation Research Board (2009).

<http://onlinepubs.trb.org/onlinepubs/circulars/ec138.pdf>

Contents:

Noise

Air Quality

Airports, Non-aircraft Emissions, and Climate Change

Water Quality

Aviation Alternative Fuels Development and Deployment

Sustainability

Environmental Review Process

Aviation Environmental Modelling Tool Suite

Technology Deployment

Introduction:

These are tumultuous times in the aviation industry, as stakeholders struggle to respond to uncertain fuel prices and availability, a global economic and financial crisis, and increased scrutiny of environmental impacts of aviation. The potential impacts of aviation on climate—and impacts of climate on aviation—are of particular concern and urgency.

Efforts to minimize environmental impacts increasingly dominate aircraft design and the design, construction, and operation of airports. As a result, environmental issues have become a fundamental constraint to increasing aviation system capacity, while constrained capacity only exacerbates environmental problems.

Some environmental impacts are well understood, while others will require significant research to understand existing and future environmental impacts and the opportunities for mitigating or avoiding them. For example, better science-based understanding of the

impacts of aviation emissions on climate change is needed to formulate an appropriate response.

In addition, improved metrics, measurement techniques, and modeling capability are needed to quantify and predict impacts and to understand interrelationships of aviation environmental issues. This circular summarizes the progress being made and suggests additional research to help achieve that vision.

Overview:

The Transportation Research Board (TRB) Environmental Impacts of Aviation Committee issued its first summary of critical issues in aviation and the environment in the United States in 2004, followed by a second edition in 2005. This revision updates and expands upon the previous circulars while maintaining their cross-disciplinary approach to reviewing subjects of interest to the civil aviation community.

It consists of nine individually authored sections representing the authoring experts' opinions on issues that address the major environmental media affected by aviation activities and the key processes that link aviation and the environment, including three sections new to this edition: climate change, alternative fuels, and sustainability.

As before, the focus is on the state of science, rather than on policy, and on identifying priority research with the potential to yield benefits during the next several years to several decades. Each section is divided into subsections that

- Define the critical issues in the subject area;
- Discuss the current state of practice, research, and policy;
- Define a vision of future capabilities that would address the critical issues; and
- Identify specific research needs to help achieve the vision.

This circular focuses on research conducted in the United States, although international activities are discussed where public or private entities in this country are closely involved. A wide range of published and unpublished material, public information, and individual contributions was collected to prepare these papers, as noted in the references at the end of each section.

Because of constraints on time and effort, the Critical Issues portions of each section do not necessarily address all potentially critical issues in a given field. For example, this circular does not fully address land use development near airports, which represents a major constraint on future aviation activity and for which effective controls remain to be developed.

Threatened and endangered species, air and drinking water quality inside aircraft and airports, and other topics also are not addressed but might be added in future revisions. The critical issues listed here have varied and evolved over time and will continue to do so. For example, while aircraft noise impacts once were preeminent among the operational environmental issues associated with aviation, air quality concerns have now achieved nearly equivalent status. Water quality issues now seem likely to assume the same sort of importance that special status species and wetlands impacts have long held.

The Current State portion of each individually authored section addresses efforts to advance the resolution of the issues now underway in the broad community of professionals concerned with aviation and the environment. To this end, TRB maintains

committees and task forces that focus on specific environmental topics, such as noise and air quality, as well as committees concerned with various aspects of aviation. The Environmental Impacts of Aviation Committee coordinates with these committees in planning meetings, annual meeting sessions paper reviews, and related matters.

The Current State portions of this circular help to further one of the Environmental Impacts of Aviation Committee's goals: to integrate the work of other TRB committees, along with research produced in the various sectors of the aviation community, into a summary document focused on research addressing the environmental impacts of aviation.

The Federal Aviation Administration (FAA) reauthorization bill enacted by Congress in December 2003 included extensive environmental provisions designed to streamline environmental review processes and mitigate noise and air quality impacts on airport communities. It also chartered the Joint Planning and Development Office (JPDO), tasked with designing and implementing the Next Generation Air Transportation System (NextGen) to accommodate future demand.

The proposed FAA Reauthorization Act of 2009 features a provision that would establish the Continuous Lower Energy, Emissions, and Noise (CLEEN) engine and airframe technology program, charged with developing technology to increase fuel efficiency by 33%, reduce landing and take-off emissions of nitrogen oxide by 60%, and reduce noise levels 32 decibels below the current international standard.

As the moves forward with NextGen, programs such as CLEEN could be vital to meeting its environmental goals of achieving absolute reductions in significant impacts on community noise levels and local air quality, limiting or reducing the impact of aviation greenhouse gas emissions on the global climate, reducing significant impacts on water quality, improving energy efficiency through the national airspace system, and supporting the development of alternative fuels for aviation.

In the meantime, the JPDO's environmental working group is developing a comprehensive environmental policy to address impacts of primary concern and establish specific targets for noise, local air quality, airport water quality, and global climate change, as well as policies to enable technology development and insertion into the fleet in a timely manner sufficient to meet NextGen environmental and capacity enhancement goals.

In 2003, two major programs focused on aviation environmental research were established: the Partnership for Air Transportation Noise and Emissions Reduction (PARTNER) and the Airport Cooperative Research Program (ACRP). PARTNER is an FAA Center of Excellence cosponsored by the National Aeronautics and Space Administration and Transport Canada, and designed to foster breakthrough technological, operational, policy, and workforce advances in aviation noise and emissions reduction. To date, PARTNER has undertaken more than 25 projects, including a 2004 report to Congress that proposed a national vision statement and recommended actions regarding aviation and environment.

The 2003 FAA reauthorization bill established the ACRP to fund research projects identified by airports as having high priority, clearly defined objectives, and immediate practical applications. To date, the ACRP has funded or approved 15 research projects

directly related to environment, including investigations into greenhouse gas emissions, hazardous air pollutants, particulate emissions, community responses to aircraft noise, alternative deicing and anti-icing formulations, alternative fuels, and a comprehensive development plan for a multimodal noise and emissions model.

The Research Needs portions of this document draw on recommendations detailed in the National Research Council report that led to the establishment of the ACRP, as well as additional needs subsequently identified by the section authors. Research needs identified in this circular could, in turn, suggest projects that can be realized through PARTNER and the ACRP.

2.10 Enviro.aero – Clearer Vision, Cleaner Sky

<http://enviro.aero/default.aspx>

The Commercial Aviation Industry Body, the Air Transport Action Group (ATAG)

**Clearer Vision
Cleaner Skies**

What is the real impact of the aviation industry on the environment? How is the industry working to reduce that impact? And what else can our industry and policy makers do?

Enviro.aero is your resource for answering these questions, and more. This site was produced by the Geneva-based Air Transport Action Group (ATAG), which is the only global association representing all sectors of the air transport industry.

Find out what we're doing in...

Technology **Operations** **Infrastructure** **Latest news**

The Flight Path

Plane Talking Blog

[Improved Navigation Performance, Paperless Flights, Hydrogen Powered Vehicles, Wind Turbines and Biofuels](#)

Fri, 14 Jan 2011 11:24:31 +0100

In the news over the last week was the announcement from Southwest Airlines that they have...

[Lufthansa is sending its seats on a diet](#)

Wed, 05 Jan 2011 16:37:38 +0100

Lufthansa Airlines from Germany is going to be spending the next year installing new seats in...

Aviation industry commits to Carbon-neutral growth from 2020
What does this mean?

Beginner's Guide to Aviation Biofuels

Beginner's Guide to Aviation Efficiency

Aviation & Environment Summit 2010
Geneva, 16-17 September 2010

Enviro.aero has been established by the commercial aviation industry body, the Air Transport Action Group (ATAG). ATAG is based in Geneva, Switzerland, and is the only global association that represents all sectors of the air transport industry. Its mission is to promote aviation's sustainable growth for the benefit of global society.

ATAG's members include airports, airlines, airframe and engine manufacturers, air navigation service providers, airline pilot and air traffic controller unions, chambers of commerce, tourism and trade partners, ground transportation and communications providers.

ATAG organises an annual Aviation & Environment Summit. In 2008 the summit resulted in an industry commitment for action on climate change, whereby 13 major companies and organisations pledged to work towards a carbon-free future. Over 120 other airlines, airports, air navigation service providers, and international and regional associations have supported this declaration.

Enviro.aero is supported and financed by the commercial aviation industry under the umbrella of the Air Transport Action Group (ATAG). Its purpose is to provide clear information on the many industry measures underway to limit the impact of aviation on the environment.

A number of ATAG's members are committed partners in this initiative.



3. Green Airports - Guidelines, Policy and Regulations

הנושא המרכזי הרלוונטי למדינת ישראל כולל במגוון תחומים העוסקים בשדות תעופה ירוקים. נושא זה נמצא באחריות של רשות התעופה האזרחית במשרד התחבורה, המשרד להגנת הסביבה ובשליטה של מדינת ישראל.

הדיון נחלק שלושה חלקים: החלק הראשון בפרק 3, עוסק במדיניות, תקנות, תכנון ותפעול של שדות תעופה אל מול אתגרי טביעת הרגל הסביבתית שלהם. פרק 4 מוקדש לנושא איכות האוויר בסביבות שדות התעופה שמקורו במטוסים ובפעילות מתקני שדה התעופה. פרק 5 מביא דוגמאות נבחרות של שדות תעופה בארה"ב, קנדה, אירופה ויפן המציגות את הבעיות הספציפיות של שדות התעופה הנבחרים. הפניות לפרויקטים של שדות תעופה נוספים נמצאות ברשימה הביבליוגרפית בפרק 7.

תקצירי המסמכים בפרק 3 ממקדים את המדיניות הכוללת של תעופה והסביבה כפי שהיא משתקפת במרחב שדה התעופה עצמו.

מסמך 3.1 של ACI-Europe - Airports council international Europe, מציג את האתגרים בתחום של תשתיות פיזיות בשדות התעופה. לטענת ACI, הממשלות אינן ששות להשתתף בעלויות התפעול של שדות התעופה וחברות התעופה אינן משלמות את מלוא העלות על השימוש תשתיות. לכן נאלצים נמלי האוויר להתבסס, במידה רבה, על מימון ציבור המשתמשים לתפעול ולפיתוח ובנוסף, להתמודד עם האתגרים הסביבתיים כמו רעש. מוצגים ארבעה אתגרים: 1. קיבולת שדות התעופה 2. אתגרי השמירה על הסביבה 3. אתגרי הנגישות לשדות התעופה, 4. הבטיחות. בשונה משאר העולם, נושאים נמלי אוויר באירופה ברוב העלויות ולא זוכים למימון ציבורי נרחב ובמסמך מעלים את השאלה של מעורבות הממשלות בהתמודדות עם האתגרים הללו.

מסמך 3.2 הוא מדריך ליישום שיתוף פעולה בנושאים של ניהול סביבתי מתואם של כל המפעילים השונים המעורבים בשדה התעופה וסביבתו.

מסמך 3.3 Instructions for Airport National Environmental Policy Act (NEPA) Implementing Projects מציג את החוק האמריקני המתייחס לדרישות הסביבתיות לגבי תפעול שדות התעופה תחת סמכות ה-FAA. החוק הוא חלק ממאמצי ה-FAA לתת הנחיות ברורות להתמודדות עם ההשפעות הסביבתיות הנוצרות כתוצאה מהפעילויות העיקריות בשדות התעופה.

מסמך 3.4 הוא מדריך מעשי (Desk Reference) ליישום החוקים הסביבתיים השונים בשדות התעופה. המדריך כולל בין היתר, פרקים על אישורים ורישיונות, יישום החוקים בפיתוח שדות התעופה ותכנים של סקר ההשפעה על הסביבה.

מסמך 3.5 המתעד שיטות מעשיות (סביבתיות, כלכליות וחברתיות) לקיימות בשדות התעופה. על בסיסם נבנה שאלון שנשלח ל-52 שדות תעופה בארה"ב ומחוצה לה. התשובות שנתקבלו מ-25 מהם מתעדות, למעשה, תפעול בר קיימא של שדות התעופה בצומת של כלכלה, חברה וסביבה.

במהלך שנות התשעים של המאה העשרים, גרמה תנופת הגידול בתנועה האווירית לביקוש גובר של קיבולת בשדות התעופה. פיתוח זה גרם, לעיתים קרובות, לקונפליקט קשה בין הצורך להרחיב את השדות ובין הדרישות הסביבתיות הנדרשות מצד אחד והתושבים המתגוררים בשכונות, מצד שני. במקרים רבים, גרם הדבר לעיכובים רבים ולעצירת הפיתוח של שדות התעופה. כדי להתגבר על הבעיה קודם מיזם – GAI – Green Airport Initiative, שמטרתו הייתה לאפשר פיתוח נמלי אוויר בשילוב עם עמידה בדרישות הסביבתיות, תוך צמצום הקונפליקטים עם האוכלוסייה. המיזם הגדיר את טביעת הרגל הסביבתית של שדה התעופה מתוך כוונה להקים שדות תעופה ירוקים יותר. המיזם של ה-GAI מאפשר לפתח אופציות של עלות-תועלת המצמצמות את התלונות של השכנים על ידי כך שהמיזם משמש כמייצג באופן מקביל את היעדים והקהילה השכנה. על כך ראו במסמך 3.6.

3.1 ACI-Europe - An Outlook for Europe's Airports: Facing the Challenge of the 21st Century

ACI-Europe - Airports council international Europe (2010).

http://www.aci-europe.org/upload/Challenges-Brochure_FINAL_lowres.pdf

Over the last decade, European citizens have enjoyed Green the benefits of unprecedented growth in trade and tourism links, between all the regions of the continent and the world beyond. These benefits are the direct result of the liberalisation of European air transport – a policy that has not only changed the rules of the game for airlines, but also led European airports to undergo a process of business transformation.

With governments unwilling to fund airport infrastructure and airlines getting unrestricted access to a European-wide airport superstore in which to shop for the best deal, airports have evolved from mere infrastructure providers dependent on public subsidies to self-financed, diversified and competitive businesses. The global economic and financial crisis that started in 2008 has only reinforced competitive pressures on airports.

While airlines are already not paying the full cost of the infrastructure they use, the consolidation process under way will result in fewer and more dominant airline groups for the 500 airports of the European aviation network. Competition will also increase externally as European airports will need to attract a growing share of fliers from fast developing nations across the globe.

These competitive pressures mean that the business transformation of airports will continue. Indeed, new business models for European airports are now emerging, with each airport striving to leverage its unique market position and increase its economic and operational efficiency. Crucially, the fact that airports have become businesses in their own right has allowed them to act as competitive dynamos for local and regional economic growth – with far reaching benefits at national and European levels.

Airport operators in Europe directly employ 156,000 staff, along with a total of 1,200,000 employees on airport sites. These airport related jobs amount to a €59 billion annual contribution to European GDP. For every 1,000 airport onsite jobs there are around 2,100 indirect jobs supported nationally.

Airports in Europe are not just supporting their local economy – increasingly, they are defining it. This situation reflects the fact that air transport lies at the heart of modern, globalised economies and that there is simply no viable substitute to the 150,000 routes that constitute the air transport network connecting Europe. However, if they are to continue to foster economic growth and job creation, a new market-based outlook of airports and their role in the European economy is needed.

Aviation is at a crossroads. The sustainability agenda means that over time, new economic and technological fundamentals will substantially redefine the entire sector. In this context, policy makers and regulators need to treat airports as dynamic and independent businesses. More specifically, European airports need to be empowered to address 4 key strategic challenges.

The Capacity Challenge Notwithstanding the global crisis, demand for air services in Europe is still expected to double by 2030. While European airports have committed a total

of 120€ billion to new facilities between 2000 and 2015, and plan an overall 41% capacity increase by 2030, this will be far from enough. Authoritative projections from EUROCONTROL show that by that time, 11% to 25% of demand for air services will not be accommodated. Europe is therefore facing an airport capacity crunch.

This will result in unprecedented levels of congestion with far reaching repercussions on the environment and the competitiveness of our economies. Airport capacity needs to become a top priority for the EU transport policy, with the aim of aligning ATM and airport capacity objectives.

This involves a full integration of airports into the new European ATM system presently under development with the Single European Sky and SESAR. There also needs to be a proactive and consistent monitoring of airport capacity at EU level, along with “best-practice” guidelines on land-use planning around airports – linking local, national and community regulations and objectives and delivering consistent processes throughout the EU.

Finally, European airports need to be empowered to move towards a more commercial approach when setting user-charges and allocating slots.

The Environmental Challenge The greening of all modes of transport represents an ambitious yet necessary policy objective. For aviation, this is an unprecedented challenge with far reaching technological and economic consequences. European airports are rising to this challenge, building on years of environmental actions. ACI EUROPE and its members have formally committed to carbon neutrality for all activities controlled by airport operators.

The launch of Airport Carbon Accreditation in June 2009 is a further step, providing an institutionally-endorsed programme that assesses and recognises efforts by airports to manage and reduce their carbon emissions. However, EU policy and regulations need to unambiguously reconcile aviation growth with ambitious environmental objectives.

This includes setting a clear priority between occasionally conflicting environmental objectives – as improvements in one area could be cancelled out by an increase in other environmental burdens. Green taxes and other blunt economic instrument should be avoided and repealed where they exist, since they do not deliver significant improvement to the environment. Europe’s airports fully support the inclusion of aviation within an open emissions trading scheme – ultimately at a world level and building on balanced European initiatives as a first step.

Exhibit 6 Examples of Environmental Initiatives at European Airports

Emission Control Standards	→ BAA Airports, UK	→ BAA has established an absolute CO ₂ emissions reductions target of 15% below 1990 levels by 2010, despite a projected growth in passenger numbers of around 70% during this period. This is being achieved through improvements in energy efficiency and conservation and through increasing the use of renewable energy sources. BAA also continues to invest in public transport alternatives for access to airports, to encourage passengers and staff to leave their cars at home.
Fixed Energy Systems for Aircraft (FES)	→ Zurich Airport, Switzerland	→ Operation of aircraft auxiliary power units (APU) which provide energy and preconditioned air to parked aircraft causes gaseous emissions and noise, thus often contributing significantly to the local air quality and site noise. As an alternative, fixed energy systems (FES) mitigate these impacts. At Zurich Airport all terminal stands connected to the concourses by passenger loading bridges provide FES. The use of APUs is subject to restrictions and airlines are obliged to use FES primarily. The ecological benefits of the FES are convincing: In 2001, the use of FES saved 12,170 t of fuel amounting to 38,500 t of CO ₂ and 75 t of NO _x . The reduction of NO _x emissions amounted to 4.3% of all airport induced NO _x emissions and 60% of all APU induced NO _x emissions.
Carbon Neutrality	→ Avinor (Norwegian Airports)	→ In 2006 Oslo Airport was one of the first airports to be declared carbon-neutral. In 2007 Avinor initiated and managed a research and documentation project, "Aviation in Norway – Sustainability and Social Benefit", in cooperation with the Norwegian airlines. To ensure a thorough and transparent process, the main stakeholders, including the three major green groups in Norway, participated in a "resource group", and The Norwegian Institute of Transport Economics and Cicero – the Centre for International Climate and Environmental Research contributed background materials to the project. The project identified over 50 emission reducing initiatives. The other 45 airports in the Avinor network were declared carbon neutral from 2008.
Wind Power Generation	→ La Palma Airport, Spain	→ La Palma Airport in the Canary Islands has become the first in Spain to be equipped with wind power generators. The plant consists of two 660kW nominal strength wind generators that produce most of the energy needed to run the airport facilities. The wind generator turbines are situated in the eastern part of the airport where they do not interfere with air navigation. Over a seven month period, 943 MWh were produced.

The Connectivity Challenge Aviation is the real worldwide web and the liberalisation of European aviation has demonstrated extended benefits. Without further improvement in Europe's air transport links with the wider world, our continent risks losing the economic and social benefits of an increasingly integrated global market place.

Yet, access to many markets outside the EU remains constrained by antiquated government to government restrictions. These restrictions often prevent hub airports from increasing existing services and regional airports from opening new international connections to improve the connectivity of their communities – for whom access to the wider world is exclusively dependent on aviation. European airports support the full liberalisation of air services agreements at EU level. Priority should be given to achieving an Open Aviation Area with the US and Canada without any restriction, to achieving a Pan-European and Mediterranean Aviation Area comprising all EU neighbouring countries by 2013 and to initiating negotiations with Brazil, Russia, India, China and Japan.

The Security Challenge In the present geo-political environment, effective security is paramount. However, the current security regime remains inefficient. It is mainly reactive, essentially focused on detection – aimed at addressing what is possible rather than what is

probable. The lack of genuine harmonisation both within the EU and across the world has only made the ideal of ‘one stop security’ – a system where checks and controls performed at airports located in other countries are fully recognised, thus avoiding duplication – all the more remote. This situation has resulted in air travel being increasingly perceived as an unpleasant experience by the travelling public. It also results in an extremely challenging operating environment with escalating costs for European airports –security now accounting for 35% of airport operating costs.

Unlike the rest of the world, European airports bear the bulk of these costs as no or very little public financing is made available for what remains a prime State responsibility. Harmonisation at EU and worldwide level needs to be guaranteed – based on the implementation of the “one stop security” concept and an increased focus on intelligence and deterrence. Public financing also needs to be made available, not least because further improvements will be deliverable only through research and new technology, which in turn will require additional investments by airports in equipment and related processes.

Indeed, it is about time that European governments bear their fair share of responsibility for funding measures protecting citizens at large. One fundamental principle binds all elements of this vision. As Europe’s airports adapt to an increasingly competitive marketplace by improving efficiency and customer service, they will need a lighter and better regulatory touch. They need to be empowered to manage their own destinies, to the benefit of all Europe’s citizens.

3.2 EUROCONTROL - Airport Environmental Partnership: A Guide Implementing Collaborative Environmental at Airports

EUROCONTROL - European Organisation for the Safety of Air Navigation (2008)
http://www.eurocontrol.int/environment/gallery/content/public/documents/CEM_final_17%2011%2008.pdf

This document is a guide to implementing Collaborative Environmental Management at airports. This guidance assists operational stakeholders wishing to establish an Airport Environmental Partnership in dealing with shared environmental challenges at and around airports. It enables Collaborative Environmental Management (CEM) by operational stakeholders such as the *Aircraft Operators, Air Navigation Service Providers* and the same is true for the resulting environmental impacts.

3.3 FAA - National Environmental Policy Act (NEPA) Implementing Instructions for Airport Projects-Order 5050.4B

Federal Aviation Administration (2006).

www.faa.gov/airports/resources/publications/orders/environmental_5050_4/media/5050-4B_complete.pdf

FAA's Office of Airports (ARP) is the FAA organization responsible for FAA decisions on major Federal actions at public-use airports.

ARP's mission. The mission of FAA's Airports organization is to provide leadership in planning and developing a safe, efficient national airport system to satisfy the needs of the aviation interests of the United States. In carrying out this mission, ARP will consider economics, environmental compatibility, and local proprietary rights, and safeguard the public investment.

Purpose of this Order. This Order provides information to ARP personnel and others interested in fulfilling National Environmental Policy Act (NEPA) requirements for airport actions under FAA's authority. This Order is part of FAA's effort to ensure its personnel have clear instructions to address potential environmental effects resulting from major airport actions. In preparing Order 5050.4B, ARP has made it consistent with Order 1050.1E.2

Information on Federal environmental laws other than NEPA appears in another document entitled, *An Environmental Desk Reference for Airport Actions*. ARP will publish notices in the *Federal Register* announcing the *Desk Reference's* availability.

Updating the Desk Reference. ARP will also issue notices when it updates the *Desk reference* to reflect changes in environmental laws, regulations, or executive orders other than NEPA. ARP will also notify airport associations of updates and request their cooperation in distributing new information.

The need to consider an action's environmental impacts. In passing NEPA, Congress recognized the importance of restoring and preserving environmental quality and declared:

“the continuing policy of the Federal Government, in cooperation with State and local governments, and other concerned public and private organizations, is to use all practicable means and measures, including financial and technical assistance, in a manner calculated to foster and promote the general welfare, to create and maintain conditions under which man and nature can exist in productive harmony, and fulfill the social, economic, and other requirements of present and future generations of Americans.” (42 U.S.C. Section 4331).

Through NEPA, Congress requires Federal agencies to consider the environmental effects of proposed actions and their reasonable alternatives.

Considering environmental impacts is the agency's responsibility. FAA begins its consideration of environmental issues early in its decision making process. Eventually, when selecting a preferred alternative, the approving FAA official often finds that FAA's mission has unavoidable environmental impacts.

The NEPA document. To select a preferred alternative under NEPA, the approving FAA official considers the environmental effects a proposed action and its reasonable alternatives would cause in meeting a defined purpose and need. During that process, the official also considers the safety, economic, technical, and engineering factors of those alternatives.

To consider the environmental effects of the no action alternative, the proposed action and its reasonable alternatives, ARP prepares or reviews environmental documents describing environmental effects proposed airport actions would cause. The Environmental Assessments (EA) ARP personnel review or the Environmental Impact Statements (EIS) they prepare provide interdisciplinary analyses showing that FAA officials have taken “ a hard look” at the environmental impacts a proposed action and its reasonable alternatives would cause.

The documents also allow FAA to provide interested agencies and the public the opportunity to review the scientific and technical information ARP personnel consider. This information focuses on environmental impacts and the conceptual measures that would mitigate those effects.

Finally, EAs and EISs provide agencies and the public with information so they can comment on those impacts and FAA’s analyses of them.

When an EA is prepared, FAA may issue a Finding of No Significant Impact to present its determination that an action would not significantly affect environmental resources. Conversely, its review of an EA may show that an EIS is needed because the actions would significantly affect those resources. After completing an EIS, FAA prepares a Record of Decision to explain the decision maker’s rationale for selecting FAA’s preferred alternative. Regardless of the document prepared, the NEPA process leads to a final FAA decision to approve or not approve a proposed airport action.

3.4 FAA - Environmental Desk Reference for Airport Actions

Federal Aviation Administration (2007).

http://www.faa.gov/airports/environmental/environmental_desk_ref/

THE DESK REFERENCE’S PURPOSE: As a compendium, the Desk Reference summarizes applicable special purpose laws in one location for convenience and quick reference. Its function is to help FAA integrate the compliance of NEPA and applicable special purpose laws to the fullest extent possible. This integration should ensure that all environmental review procedures applicable to an airport action run concurrently rather than consecutively.

The Desk Reference includes information addressing ways to evaluate potential environmental impacts due to a proposed airport action, and when appropriate, its reasonable alternatives. It also provides information on mitigation measures.

If a conflict between a special purpose law and this Desk Reference occurs, the special purpose law takes precedence and should be relied upon. When citing a legal requirement, the responsible FAA official or other user should cite the law, order, or regulation specifying the requirement, not the summary or description in the Desk Reference. ARP issues this

Desk Reference to be more responsive to changes in the array of special purpose laws that are amended more often than NEPA and the CEQ regulations implementing NEPA.

ARP believes the Desk Reference is the most flexible and quickest way to provide updated information in this changing legal and regulatory environment. To ensure rapid distribution, ARP has placed the Desk Reference on its web site.³ ARP will use this web site to distribute future changes to this Desk Reference as needed.

Environmental assessments (EAs) that airport sponsors (or their consultants) prepare for FAA and the environmental impact statements (EISs) that FAA prepares are key parts of ARP's decision making process for airport actions. Therefore, responsible FAA officials must meet the requirements of Order 5050.4B when preparing those documents. In addition, ARP recommends that responsible FAA officials and other users refer to this Desk Reference for guidance to help integrate applicable special purpose laws with NEPA.

DESK REFERENCE ORGANIZATION: ARP has organized each chapter of the Desk Reference in the same manner to provide consistency in the presentation of material. Each chapter is arranged according to the following headings:

1. INTRODUCTION AND DEFINITIONS.
2. APPLICABLE STATUTES AND IMPLEMENTING LAWS OR REGULATIONS.
3. APPLICABILITY TO AIRPORT DEVELOPMENT ACTIONS.
4. PERMITS, CERTIFICATIONS, AND APPROVALS.
5. ENVIRONMENTAL COMPLIANCE PROCEDURES - ENVIRONMENTAL ANALYSIS.
6. DETERMINING IMPACTS.
7. DETERMINING IMPACT SIGNIFICANCE.
8. ENVIRONMENTAL IMPACT STATEMENT CONTENT.

Sections 1 through 7 of each chapter apply to EAs and EISs as they relate to applicable special purpose laws and, as needed, the analysis of extraordinary circumstance related to categorical exclusions. Section 8 applies solely to EISs.

USING THE DESK REFERENCE: should assist responsible FAA officials and other users in meeting the requirements of the special purpose laws applicable to the No Action alternative, the proposed action, and, as fitting, reasonable alternatives. Conducting the analyses the special purpose laws require is a critical part in completing the interdisciplinary analyses NEPA requires for airport actions. If there are instances where ARP staff or another user requires more information or has a question about a specific FAA policy, they should contact the lead environmental specialist in the Regional Airports Division office responsible for the proposed airport action. As needed, that specialist may contact Regional Counsel, the Office of Airports, Planning and Environmental Division (APP-400), or the Office of the Chief Counsel, Airports Environmental Law Division (AGC-600) for more information.

3.5 ACRP-TRB - Airport Sustainability Practices: A Synthesis of Airport Practice

Airport cooperative Research Program, ACRP SYNTEHSIS 10 (2008).
http://onlinepubs.trb.org/onlinepubs/acrp/acrp_syn_010.pdf

This project was undertaken on behalf of TRB. The report documents a range of airport sustainability practices gathered from a literature review and web-based survey. It specifically targets airport operators and provides a snapshot of airport sustainability practices across the triple bottom line of environmental, economic, and social issues. A literature review was undertaken to inform the development of a survey for airport operators to identify current sustainability practices. After the survey, another literature review was undertaken to supplement the survey findings.

The web-based survey included questions related to the management of environmental, economic, and social practices at airports; current and future drivers and priorities; and barriers to implementing sustainability. The survey was issued to 52 persons at U.S. and non-U.S. airports. Twenty-five survey responses were received from a range of large, medium, small, and non-hub U.S. airports, and from airports in the United Kingdom, Europe, Asia, and Canada. The survey asked respondents to assess their airport in relation to environmental, economic, and social sustainability performance using an ordinal management performance scale. Respondents were encouraged to identify practices that were planned or in place at their airport.

On overall sustainability performance, respondents from non-U.S. airports and large U.S. airports rated their airports' performance higher than those from small and medium U.S. airports. Respondents identified regulation and airport policy as key drivers for the implementation of sustainability practices. For the future, they cited stakeholder concerns and global concerns such as climate change.

For the next five years, large U.S. and non-U.S. airports consistently identified environmental sustainability practices as a priority. Smaller U.S. airports were more focused on economic prosperity. Corporate social responsibility and strategic environmental management at the governance level were key future priorities for some non-U.S. airports. For all the airport respondents, funding was the predominant barrier to implementation of sustainability practices. Responsibility for these practices at airports was not restricted to an environmental manager but varied across a range of disciplines and management levels. Respondents from both U.S. and non-U.S. airports said that environmental training is offered at their airport; economic and social sustainability training were not mentioned as often.

Environmental reporting, whether as part of an annual report or separately, was common among the survey respondents. However, of the 25 respondents, only 4 non-U.S. respondents said that their airport uses the Global Reporting Initiative sustainability reporting guidelines for environmental, economic, and sustainability performance. Environmental practices commonly in place at airports include measuring and monitoring water conservation, water quality, climate change, air quality, land use, biodiversity, environmentally sustainable materials, waste, noise and aesthetics, energy, and green buildings.

Economic sustainability practices commonly in place at airports include local hiring and purchasing, contributing to the community, quantifying the value of sustainability practices, contributing to research and development, and incentivizing sustainable behaviour. Social concerns at airports include public awareness and education, stakeholder relationships, employee practices and procedures, sustainable transportation, alleviating road

congestion, accessibility, local culture and heritage, indoor environmental quality, employee well-being, and passenger well-being.

Contents:

CHAPTER ONE INTRODUCTION:

Audience and Dissemination, Background, TRB Panel, Definitions, Issues Addressed, Report Content

CHAPTER TWO METHOD:

Literature Review, Survey

CHAPTER THREE SURVEY RESPONSE:

Survey Respondents, Airport Authorities, Geographic Location, Airport Size

CHAPTER FOUR DRIVERS, PRIORITIES, AND BARRIERS TO SUSTAINABILITY PRACTICES:

Existing and Future Drivers for Sustainability, Sustainability Priorities Barriers to Implementation

CHAPTER FIVE ORGANIZATIONAL GOVERNANCE OF SUSTAINABILITY:

Roles and Responsibilities, Training, Sustainability Organizations, Public Reporting

CHAPTER SIX ENVIRONMENTAL PRACTICES:

Environmental Sustainability Self-Assessment, Measurement and Monitoring, Water, Air Quality, Climate Change, Land Use, Biodiversity, Materials, Waste Management, Noise Pollution and Aesthetics, Energy, Green Building

CHAPTER SEVEN ECONOMIC PRACTICES:

Economic Sustainability Self-Assessment, Local and Responsible Economic Practices, Community Contributions, Valuing Sustainability, Sustainability Research and Development, Incentives for Sustainable Behaviour

CHAPTER EIGHT SOCIAL PRACTICES:

Social Sustainability Self-Assessment, Stakeholder Relationships, Employee Practices and Procedures, Transportation, Accessibility, Local Identity, Culture, and Heritage, Indoor Environmental Quality, Employee Well-Being, Passenger Well-being

CHAPTER NINE CONCLUSIONS

APPENDIX A

Airport Sustainability Practices Survey

APPENDIX B

Management Performance Scale

APPENDIX C

List of 25 Airports Responding to Survey

APPENDIX D

List of Sustainability Practices Captured by Survey

3.6 Green Airport Initiative

The Clean Airport Partnership (CAP) (2004).
www.cleanairports.com/reports/GAI.pdf

Background

Throughout the 1990s, a major issue for airports was that opportunities posed by airport growth were seemingly in conflict with requirements of environmental regulators and

concerns of local residents. General conformity regulations stymied many airport construction projects. Communities felt that airports had fallen short in tackling the broad range of environmental issues associated with day to day operations. Case studies have shown that community activists are becoming increasingly effective in obstructing expansion plans unless their problems are adequately addressed and nuisance factors minimized. They also view the airport planning process with skepticism as a legal mechanism for skirting their concerns. The net result is reflected in the delays and rancor witnessed by Boston Logan in their 20 year effort to expand, as well as at other airports nationally.

The Remedy

The Green Airport Initiative (GAI) is designed to help airports achieve quick and measurable benefits in environmental quality and energy savings and reduce conflicts with local communities. Its goal is not just to make airports greener but to accommodate their growth in a manner illustrating the principles of sustainable development and creating more livable communities. The GAI is not a mechanism for trading off airport growth for environmental quality but a strategy for increasing both. In contrast to the traditional master planning process, the GAI is a proactive approach for an airport to develop an environmental posture that accommodates the community's concerns while still meeting all regulatory requirements. Through the mechanism of the GAI, cost-effective options for reducing community nuisance are identified.

The GAI was conceived as a semi-autonomous environmental planning vehicle, although its findings and conclusions can easily be integrated into the master planning process. The GAI fosters the consideration of innovative but proven technologies and operational practices that are tailored to the needs of the local community. By remaining independent, it creates a credible mechanism that engages the community in problem solving and then fosters cooperation to obtain the political and financial support to pursue strategies that speak to community concerns and opportunities. Operating in this capacity, the GAI can play a pivotal role in simultaneously addressing the goals of the airport and the community and creating an environment conducive to partnership and growth.

The GAI Process

The GAI is composed of two primary phases. The *baseline phase* can typically be completed within six months. The findings of this process dictate the magnitude of effort required to complete the *implementation phase* of the GAI. Where "showcase" opportunities exist for emerging technologies or operational practices, airports may be able to obtain supplemental government, Congressional, and private sector funding support. Throughout the process airports are presented opportunities for working with government at all levels, the private sector, and the local community to cultivate the support needed to implement key programs.

Baseline

Document Environmental Profile - Current accomplishments, which when linked are sometimes substantial, are often unrecognized by either the airport or the public.

Initiate Stakeholder Outreach - Creating a process for cultivating constructive community involvement begins with outreach and designing a visioning process, which among other things acquaints the community with opportunities associated with improved operations.

Define Concepts and Opportunities - Identifying innovative but proven strategies can simultaneously improve environmental quality, enhance energy efficiency, and reduce costs.

Implementation

Create an Implementation Roadmap - Creating a blueprint for implementing and tracking the GAI sets the stage for program success.

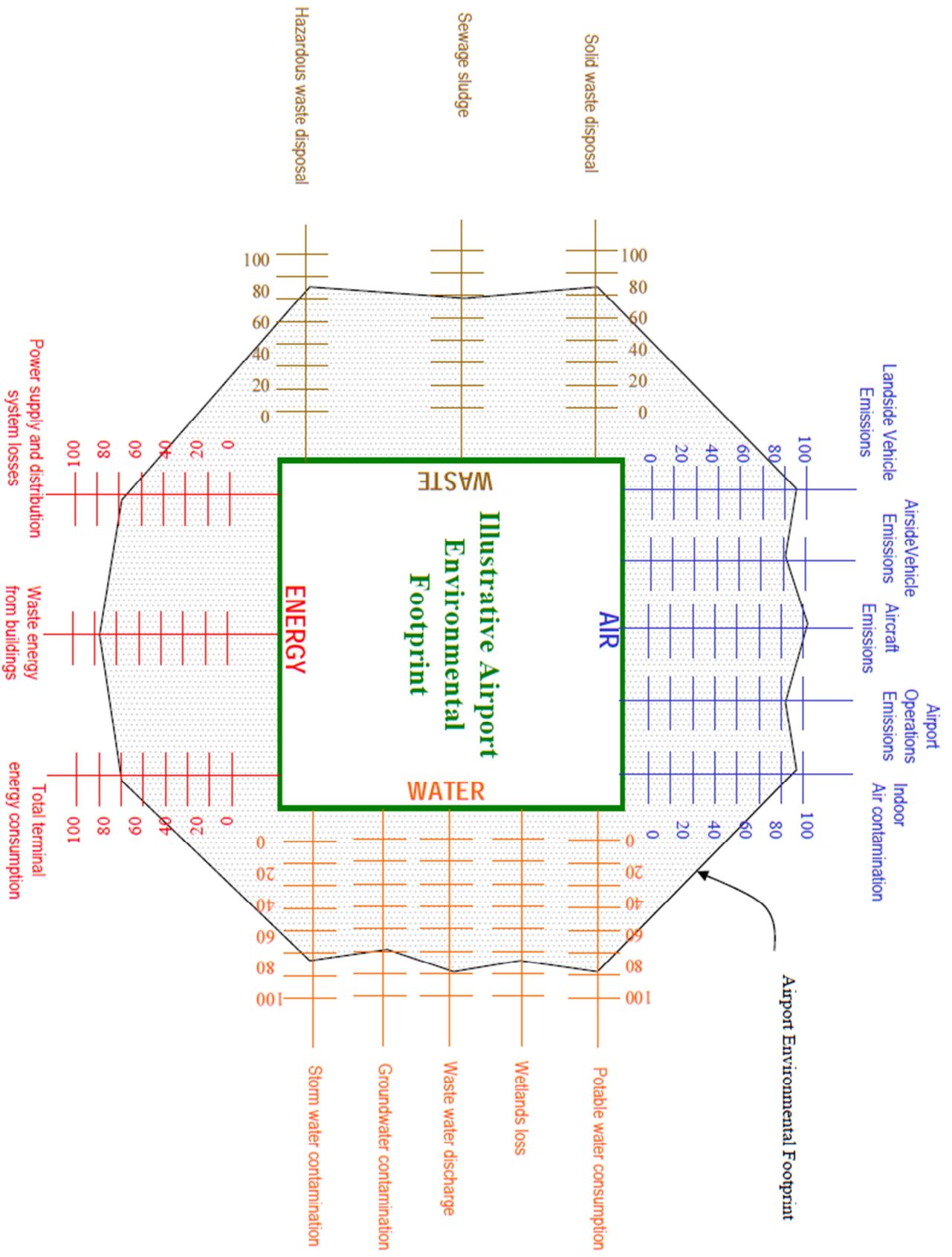
Develop Detailed Project Plans - Conducting a detailed analysis of strategies and developing a detailed and comprehensive work plan integrates GAI goals with other developments at the airport.

Secure Project Resources - Obtaining the technical, in-kind, and financial resources necessary to implement key strategies reduces the airport's outlay.

Measure and Verify Results - Assessing and monitoring the effectiveness of programs implemented demonstrates the value of the GAI to the airport and community.

About CAP and the GAI

The Clean Airport Partnership, Inc. is a non-profit corporation established to help airports and communities work together to improve environmental quality. CAP's implementation team is uniquely equipped to provide customized support to airports and communities across the country. The GAI is supported with funding from the U.S. Department of Energy, the U.S. Environmental Protection Agency, the Rockefeller Family Fund, the U.S. Congress, and participating airports.



4. Green Airports – Environmental Quality (Air, Soil and Water)

שדות תעופה באירופה מתמודדים מזה עשרות שנים ברמה המקומית עם אתגרים סביבתיים בעיקר של איכות האוויר זיהומי קרקע, איכות המים וסכנות זיהום של מקורות מים. אולם התפתחות הדיון בשינויים אקלימיים ברמה הגלובלית הוסיפו מימד חדש להתמודדות זו. שדות התעופה נדרשים לעמוד בדרישות הולכות ומחמירות להוכיח את התאמתם למדיניות סביבתית ולתקנותיה הקשורות להשפעות מעבר לסביבה הקרובה.

לשם כך נכתב המדריך של ICAO (מסמך 4.1) להתמודדות עם איכות האוויר בשדה התעופה וסביבתו. המדריך כולל פרקים על המסגרת הרגולטורית וגורמים מדרבנים אחרים למדידת איכות האוויר, מדידת הפליטות והטיפול בהן. מטרת המדריך היא לתת עצות מעשיות ומידע המבוסס על שיטות שנוסו בהתמודדות עם הבעיה. במדריך יש הנחיות כיצד לייסד הליכים המתאימים ביותר לגישת המדינות השונות ומוצגת מסגרת אנליטית המגדירה את השיטות הטובות ביותר לצרכים שונים או לתרחישים אפשריים. בהמשך מוצגת המסגרת שלפיה המדריך מציג את ההנחיות כיצד להעריך את איכות האוויר – רגולציות המעודדות תקינת סטנדרטים למקורות פליטה ולהגדרת הליכים שיתאימו לרגולציות. לדוגמה מוצג גרף המתאר את היחסים בין הדרישות להערכת איכות האוויר.

ביוזמת ACI-EUROPE, אומצו אמות מידה מוגדרות לפליטת פחמן (סעיף 4.2) וב-2009 פותחה הסכימה של Airport Carbon Accreditation. הבדיקה והאקרדיטציה של נמלי התעופה נעשית בכל שנה ומופעלת על ידי חברת ייעוץ המתמנה על ידי ACI-EUROPE. זהו כלי וולונטרי המסייע לצרף את שדות התעופה כציר מפתח בתחום התעופה למאמץ לקראת קיימות. כך, שדות התעופה נהנים משורה של יתרונות כלכליים ותדמיתיים המקלים עליהם, בין השאר, להמשיך ולפתח את התשתיות באמצעות זכייה ב"רשיון לגדול", בתמורה לגישה האקטיבית שלהם לצמצום פליטות.

מסמך 4.3 מציג יוזמה משותפת של ארה"ב וקנדה לצמצום הפליטות באזורי שדות התעופה. ב-325 שדות תעופה נמדדו ההשפעות של פעילותם על האזורים הסמוכים להם. המדידות התייחסו לפליטות בהליכי הפעלת המנועים ליד השערים, הסעה אל המסלולים, המראות, יציאה מאזור שדה התעופה והנחיתות. הנתונים מאפשרים לימוד ההשפעה על שדה התעופה והאזורים הסמוכים ומשמשים כתמריץ להגדלת היעילות בצריכת הדלק בתפעול מטוסים בשדה התעופה ובצמצום הפליטות.

מסמך 4.4 שנכתב ב-2010 למשרד הקיימות והסביבה האוסטרלי, הוא מדריך לשיטות מעשיות לשימוש יעיל במים. הבטחת מקורות מים עצמאיים ומובטחים הם חלק חשוב מכל פעילות סדירה של שדה התעופה. מים משמשים לניקיון ותחזוקה של מטוסים, מכונות להשכרה, שטחים ירוקים, שירותי הסעדה ואירוח, שירותים, מגדלי קירור ועוד. בשדות התעופה מתמודדים עם בעיות של נגר עילי, איכות מים, בעיות סחיפה וזיהום קרקע, נזילת מים ממבנים ישנים ועוד. לכן יש צורך ליישם תוכניות לניהול בר-קיימה של מים כחלק מאסטרטגיה סביבתית כוללת.

מסמך 4.5 המתאר את האסטרטגיה הסביבתית של נמל התעופה מתייחס, בין היתר, לנושא של מניעת זיהום קרקע ומי תהום הנגרם בשל מגוון הפעילויות של שדה התעופה.

מסמך 4.6 "ניהול פסולת תעשייתית בשדות התעופה" מתייחס ספציפית להנחיות ולחוקים כיצד להתמודד עם מי הביוב שנוצרים מפעילות שדה התעופה.

4.1 Airport Air Quality Guidance Manual

ICAO - International Civil Aviation Organization (2007).
http://www.icao.int/icaonet/dcs/9889/9889_en.pdf

Preface

This first edition of the guidance manual includes chapters on the Regulatory Framework and Drivers for local air quality measures, Emissions Inventory Practices and Emission Temporal and Spatial Distribution.

Purpose

This guidance document contains advice and practical information to assist ICAO Contracting States in implementing best practices with respect to airport-related air quality. Information related to State requirements, emissions of airport sources, emission inventories and emissions allocation are addressed throughout the document.

The document also provides a process for States to determine the best approaches and analytical frameworks for assessing airport-related air quality and identifies best practices for different needs or scenarios. It is not intended as a basis for any regulatory action, it does not describe specific projects or actions nor does it address research-related aspects of airport air quality.

The Committee on Aviation Environmental Protection

ICAO has been involved with airport-related emissions for many years. In particular, the ICAO Committee on Aviation Environmental Protection (CAEP) and its predecessor, the Committee on Aircraft Engine Emissions, have continually addressed emissions standards for new engine types, their derivatives and new production engines since the late 1970s. One of the principal results arising from their work is the ICAO provisions on engine emissions in Volume II of Annex 16 to the Convention on International Civil Aviation (the “Chicago Convention”). Among other issues, these provisions address liquid fuel venting, smoke and the following main gaseous exhaust emissions from jet engines: hydrocarbons (HC), nitrogen oxides (NO_x) and carbon monoxide (CO). Specifically, they set limits on the amounts of smoke and gaseous emissions of these three pollutants in the exhaust of most civil engine types. In addition to technological innovation and certification standards, CAEP also has pursued two other potential approaches for addressing aviation emissions: (1) alternative airfield operational measures and (2) the possible use of market-based emission reduction options.

Background

Interests in aircraft and airport air pollutant emissions have been rising ever since the substantial increase in commercial turbojet traffic in the 1970's. For example, aircraft emissions produce air contaminants such as NO_x, HC, and fine particulate matter (PM), which in turn can become involved in broader environmental issues related to ground level ozone (O₃), acid rain, climate change, and present potential risks relating to public health and the environment. Unlike most transportation modes, aircraft travel great distances at a variety of altitudes, generating emissions that have the potential to impact air quality in the local, regional and global environments.

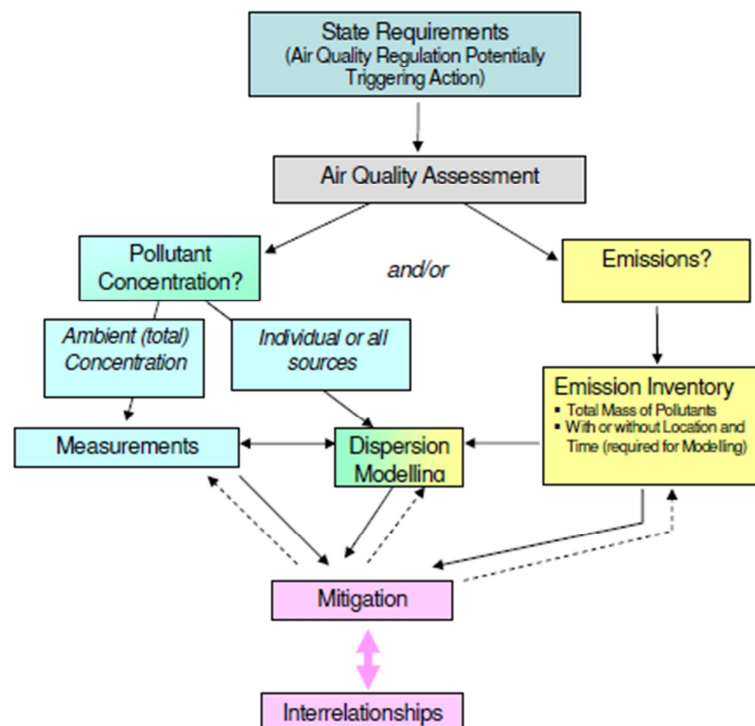
ICAO also recognizes that airport-related sources of emissions have the ability to emit pollutants that can contribute to the degradation of air quality of their nearby communities. As such, national and international air quality programs and standards are continually requiring airport authorities and government bodies to address air quality issues in the vicinity of airports. Similarly, attention must also be paid to other possible airport-related environmental impacts associated with noise, water quality, waste management, energy consumption and local ecology in the vicinity of airports, to help

ensure both the short- and the long-term welfare of airport workers, users, and surrounding communities.

Notably, significant improvements have been made over the past two decades regarding aircraft fuel efficiency and other technical improvements to reduce emissions. However, these advancements may be offset in the future by the forecasted growth of airport operations and other aviation activities. Because aircraft are only one of several sources of emissions at an airport, it is also considered essential to effectively manage emissions from terminal, maintenance and heating facilities; airport ground service equipment (GSE); and various ground transport travelling around, to and from airports. Optimizing airport design, layout and infrastructure; modifying operating practices for greater efficiencies; retrofitting the GSE fleet to “no-“or “low-” emitting technologies; and promoting other environmentally-friendly modes of ground transport are some of the current opportunities airports and the rest of the aviation industry can adopt or apply to help meet these goals and encourage sustainable development in commercial air transportation.

Air Quality Assessment

In most areas, air quality is regulated by a combination of national, regional and/or local regulations that establish standards on emission sources and/or ambient (i.e. outdoor) levels of various pollutants, and define the procedures for achieving compliance with these standards. For example, The Figure shows the relationship of the principle requirements of an air quality assessment reflecting this legal framework.



As shown, the two main areas of an air quality assessment are (1) the emissions inventories and (2) the dispersion modelling of pollution concentrations. An emission inventory gives the total mass of emissions released into the environment and provides a

basis for reporting, compliance, mitigation planning, and can be used as input to modeling pollution concentrations. In order to link emissions to pollution concentrations, the spatial and temporal distribution of the emissions have to be assessed as well. This combined approach of using emission inventories and dispersion modeling enables the assessment of historical, existing, and/or future pollution concentrations in the vicinities of airports or from individual emission sources. Existing pollution concentrations can also be assessed by measuring (e.g. sampling and monitoring) ambient conditions; although this assessment method can include contributions from other nearby and distant sources, including those that are non-airport related. Depending on the specific task, computer modelling results and ambient measurements can be used for evaluating existing or historical conditions. In contrast, future conditions can only be simulated using computer modelling. The emission inventory, concentration modelling and ambient measurement elements of an air quality assessment can be used individually, and or combination, to aid the process of understanding, reporting, compliance and/or mitigation planning by providing information on overall conditions as well as specific source contributions.

Subsequent air quality mitigation or other implemented measures – with proper consideration of the interrelationship with, primarily noise and other airport environmental impacts – can have beneficial results on the total emission mass, the concentration model results, and measured concentrations.

4.2 ACI-EUROPE - Airport Carbon Accreditation Annual Report 2009-2010

ACI-EUROPE & WSPGROUP (June, 2010).
<http://www.airportcarbonaccreditation.org/>

An Introduction to Airport Carbon Accreditation

Context

European airports have been actively dealing with environmental concerns on an individual basis for decades, focusing on local impacts in relation to noise, air quality, water and biodiversity. However, the global nature of climate change is bringing a new kind of exposure and challenge to industries that are perceived to have a high environmental impact or significant emissions sources. As a result, a collected and co-ordinated industry response is required to ensure that European airports can demonstrate their evolutionary approach to improved performance commensurate with their business cycle and be able to demonstrate compliance, policy and legislative, in order to facilitate “licence to operate and grow”.

According to the Intergovernmental Panel on Climate Change (2001), aviation contributes around 2% of global man-made CO₂ emissions, but it is recognised that this proportion may increase over time. It is estimated that airport activities account for up to 5% of total aviation emissions. Along with other aviation industry stakeholders, European airports are seeking to address the challenge of climate change and have developed a wide range of activities to reduce carbon emissions linked to airport operations. These emissions stem mainly from: energy use in airport buildings and infrastructure; transport to/from airports; air-side vehicles; aircraft ground movements and energy consumption and refrigerants.

In June 2008, the annual assembly of ACI EUROPE adopted a landmark resolution on Climate Change when its member airports committed to reduce carbon emissions from

their operations, with the ultimate goal of becoming carbon neutral. One year later, at the 2009 annual assembly, ACI EUROPE launched *Airport Carbon Accreditation*, allowing the assessment and recognition of participating airports' efforts to manage and reduce their CO2 emissions.

Airport Carbon Accreditation is an independent scheme administered by WSP Environment & Energy, an international consultancy appointed by ACI EUROPE to enforce the accreditation criteria for airports on an annual basis.

Scheme Aspirations, Aims and Benefits

Airport Carbon Accreditation has been specifically developed to assess and recognise airport efforts to manage and reduce their GHG emissions and to ensure that suitable management processes are in place that will enable emissions reductions to be identified, and that reductions are achieved. It is intended to set a leading example of corporate leadership in responsible business practice.

It is the only industry specific performance-based, voluntary, pan-European and institutionally endorsed accreditation label. As such it is a significant step in the standardisation of emissions reductions across airports and follows a goal set down by ACI EUROPE for its airports to move towards carbon neutral operations.

Aviation is a highly-visible industry and for this reason, *Airport Carbon Accreditation* not only underlines the direct activities of airports, but also collaborative efforts with airlines, air traffic control, ground handlers and others – as part of a comprehensive strategy towards aviation's presence on the ground. It is intended that through the recognition of real reductions in emissions increased participation in *Airport Carbon Accreditation* will improve the external perception of European airports' environmental performance, and contribute to operators' credibility through independent endorsement and accreditation of carbon measurement and management.

Participation also demonstrates leadership in addressing climate change and is intended to convey the key message that airports are dealing with their environmental impacts and are committed to doing even more in future. As such, *Airport Carbon Accreditation* is a unique tool for engaging the airport industry on the path towards improved sustainability and carbon neutrality

Key benefits of participation that have been identified by the Advisory Board and ACI EUROPE members individually include:

- Demonstrating that airport strategic decisions consider climate change and CO2 emissions
- Increasing airports public profile and credibility
- Reducing exposure to climate change regulatory risk
- Supporting efforts to justify a „license to grow“
- Helping to deliver significant financial benefits (an estimated 5-10% reduction in annual operating costs in the short term)
- Demonstrating proactive management of CO2 emissions sources and increased operational efficiency
- Providing a common management tool and framework to reduce emissions
- Acting as vehicle for the exchange of information and development of best practice
- Contributing to a positive public reputation of the airport industry

Scheme Requirements

Airport Carbon Accreditation acknowledges that airports are at a number of different points on a journey towards comprehensive carbon management and carbon neutrality. The step-by-step process encourages airports to reduce their carbon emissions with the ultimate goal of carbon neutral operations.

By providing airports with a common framework for active carbon management, *Airport Carbon Accreditation* assesses and recognises efforts to manage and reduce carbon emissions from airport operations.

Performance recognition is ensured with four levels of accreditation: **mapping, reduction, optimisation and neutrality.**

Reporting standards are based on established greenhouse gas accounting methodologies, such as the World Business Council for Sustainable Development (WBCSD) and the World Resources Institute (WRI) Greenhouse Gas Protocol, as well as airport specific standards such as the International Civil Aviation Organisation's (ICAO) definition of the Landing-Take Off cycle and other airport specific guidance in carbon foot printing and management. Airports must have carbon footprints independently verified in accordance with ISO14064, for which evidence must be provided to the scheme Administrator. All claims regarding carbon management processes must also be independently verified.



4.3 PARTNER - Aircraft Impacts on Local and Regional Air Quality in the United States - Final Report

Partnership for AiR Transportation Noise and Emissions Reduction Project, An FAA/NASA/Transport Canada sponsored Center of Excellence (2009).

<http://web.mit.edu/aeroastro/partner/reports/proj15/proj15finalreport.pdf>

Executive Summary

This report documents the findings of a study undertaken to identify:

The impact of aircraft emissions on air quality in nonattainment areas (NAAs);

Ways to promote fuel conservation measures for aviation to enhance fuel efficiency and reduce emissions;

Opportunities to reduce air traffic inefficiencies that increase fuel burn and emissions.

This study was conducted by the Partnership for AiR Transportation Noise and Emissions Reduction (PARTNER), an FAA/NASA/Transport Canada-sponsored Center of Excellence.

The study was conducted through the coordinated efforts of five contractors and subcontractors. Aircraft landing take-off (LTO) emissions include those produced during idle, taxi to and from terminal gates, take-off and climb-out, and approach to the airport. Aircraft LTO emissions contribute to ambient pollutant concentrations and are quantified in local and regional emissions inventories.

This study analyzed aircraft LTO emissions at 325 airports with commercial activity (including 263 commercial service airports and 62 airports that are either reliever or general aviation airports) in the U.S for operations that occurred from June 2005 through May 2006. The flights studied represent 95% of the aircraft operations for which flight plans were filed during that time period (and 95% of the operations with International Civil Aviation Organization (ICAO) certified jet engines in the U.S.). Of the 325 airports, 148 are commercial service airports in ambient air quality nonattainment areas as specified by the National Ambient Air Quality Standards (NAAQS) (40 CFR Part 50).

The airports involved are identified in Appendix B; the nonattainment areas are listed in Table 3.1. Each of these NAAs has at least one commercial service airport. The study was designed to focus on the impact of aircraft emissions on air quality in NAAs. As is shown in Table 1.1, aircraft operations at the 148 commercial service airports in the 118 NAAs are less than 1 percent of emissions in these areas. Aircraft emissions data from 2005 were used for this study. In the table, non-aircraft emissions data are from EPA's year 2002 National Emissions Inventory. Note that EPA's year 2001 National Emissions Inventory was used for modeling the impact of aviation emissions on air quality and human health; see section 3.1 for details. (Note, some of the general aviation airports and reliever airports studied were located in NAAs, but they were not included with the below inventories for NAAs.

The aircraft emissions from these airports are estimated to be a small fraction of the aircraft emissions in NAAs compared to those from commercial service airports because commercial aircraft are generally larger than general aviation aircraft and thus burn more fuel; emissions are proportional to fuel burn.)

4.4 Water Efficiency Opportunities: Airports - Best Practice Guide.

Australian national university for department of sustainability, environment, water, population and communities (December, 2010)

<http://www.environment.gov.au/water/publications/urban/pubs/weo-airport-guide.pdf>

Secure and dependable water resources are essential for the operation of any successful airport. Water is essential for cleaning and maintaining aircraft and rental cars, maintaining grassed areas and landscapes, operating cooling towers and basic amenities, as well as for food and hospitality outlets within the airport complex

As climate changes, there are higher probabilities of variations in water availability from year to year and of more extreme weather events whether this be flooding or drought. Even without climate change, airports have significant stormwater run-off, water quality and soil erosion issues to manage, as rain events can create significant levels of stormwater due to

airports having predominantly impervious surfaces. Also, over time, water and trade waste costs have increased and are likely to continue to do so. The large size of many airports also means that they can be prone to water leakage from aging infrastructure. Clearly then, the business case for better managing water resources is strong. This is shown by the fact that increasingly capital city and regional airports around the world are developing and implementing sustainable water management plans as part of a broader environmental strategy. A strategic approach to water management is increasingly seen to be sensible business practice to pro-actively manage risks whilst identifying and implementing win-win environmental and financial bottom line improvements. Empirical evidence also suggests that significant water efficiency improvements can be achieved in airports cost effectively.

4.5 Sydney Airport Environment Strategy 2010 – 2015 - Water Management

Sydney Airport (2009).

<http://www.sydneyairport.com.au/SACL/DownloadDocument.ashx?DocumentID=1069>

Conventional management of discrete systems for water consumption, groundwater protection and the treatment or disposal of wastewater/stormwater is no longer considered appropriate. In light of the forecast growth in aviation activity at Sydney

Airport and the need to simultaneously provide adequate environmental protection, there is a need for an integrated approach to water management at Sydney Airport. This Environmental Action Plan therefore reflects an integrated strategic approach to these three water-related environmental aspects.

Key Objectives - Manage the water impacts of the airport through:

- minimizing potable water use by using alternative water sources where appropriate;
- minimizing the impact of airport operations on water quality in water bodies on or adjacent to Sydney Airport;
- preventing soil and groundwater contamination occurring from airport activities;
- managing known and suspected contaminated sites in accordance with regulatory requirements

4.6 Management of Airport Industrial Waste

U.S. department of transportation and Federal aviation administration (2008)

http://www.faa.gov/documentLibrary/media/advisory_circular/150-5320-15A/150_5320_15a.pdf

PURPOSE: This advisory circular provides basic information on the characteristics, management, and regulations of industrial wastes generated at airport such as Industrial Wastewaters. Industrial wastewaters are generally characterized in terms of conventional pollutants and priority pollutants.

Airport Industrial Wastes: Although airports are not usually considered as industrial complexes, daily activities, such as aircraft and ground vehicle washing and cleaning, fueling operations, aircraft maintenance and repair work (including painting and metalwork), engine test cell operations; de/anti-icing operations, and ground vehicle maintenance, are all sources of airport industrial wastes. Wastes generated by these activities that are addressed by this AC are categorized as either industrial wastewater, hazardous or non-hazardous wastes

Conventional pollutants include oil and grease, total suspended solids (TSS), pH, and biochemical oxygen demand (BOD5). The priority pollutant list is located in Appendix B.

Specific examples of water quality issues in airports are demonstrated in section 7.6 in the bibliography.

5. Green Airports - Specific Airports

בפרק זה מוצגים ארבעה שדות תעופה במדינות שונות המתמודדים עם אתגרי הסביבה והקיימות אל מול הרצון להמשך פיתוח וצמיחה. בנוסף יש הפניות לשמונה שדות תעופה נבחרים ברשימה הביבליוגרפית. מעיון בעבודות שנעשו בשדות התעופה הללו, ניתן ללמוד רבות על נסיונות, גישות ודגשים בעיצוב תוכניות ניהול סביבתיות וישומן.

הנהלת שדה התעופה Dallas/Fort Worth (מסמך 5.1), גיבשה תוכנית לניהול נושאי סביבה שלה שעיקרה 12 מרכיבי מפתח המבוססים על הנחיות המשרד להגנת הסביבה (EPA). שלושה צירים מרכזיים מנחים את התוכנית: מניעת זיהום, צמצום מקורות הזיהום והפחתת פסולת. המחויבות הכוללת של כל הגורמים המפעילים את שדה התעופה הביאה להכרה בעמדת המנהיגות בנושא תעופה-סביבה בארה"ב כפי שהוכרו על ידי המחלקות לאיכות הסביבה בטקסס והרשויות הפדרליות.

בסעיף 5.2 מוצג נמל התעופה גטוויק, שבעבורו הוכנה תוכנית אסטרטגית סביבתית לעשר השנים הבאות. הגישה בשדה התעופה היא לממש את מחויבותו לשמירת סטנדרטים סביבתיים גבוהים ובמקביל לראות בכך כלי שעשוי לסייע בתחרות כשדה הנבחר של לונדון. שדה התעופה יצר קשר עם כל הגורמים הפועלים בשדה כדי לוודא שהיעד הסביבתי ממומש על ידי כולם. במסגרת התוכנית האסטרטגית כוללת אמצעים לצמצום הפליטות, הפחתת הרעש, הפחתת ההשפעה של גורמי התפעול בנמל התעופה בצריכת אנרגיה, בכמות הפסולת, באיכות המים וצריכתם התוכנית מפרטת עשרה יעדים להגשמת המדיניות ויישום התוכנית הסביבתית.

בסעיף 5.3 מוצגת תוכנית אב של נמל התעופה נריטה ביפן שהושלמה ב-2010 תחת הכותרת Eco Airport. הגישה בשדה תעופה זה מאמצת יוזמות אקטיביות מתוך פרספקטיבה גלובלית לצד פיקוח הדוק של ההשפעה האזורית של שדה התעופה ולכן לדוגמה, ההתמודדות עם הרעש עומדת במקום הראשון. לשם המחשה, אגרות הנחיתה מתבססות על אינדקס רעש שאומץ על ידי שדה התעופה. לאור הלחצים הגדולים של תושבי הסביבה, חלק חשוב מן התוכנית כולל שיתוף פעולה עם הקהילה, שילוב כל הגורמים הפעילים בשדה בתוכנית ותרומה לקהילה.

בסעיף 5.4 מוצג הדוח הסביבתי של נמל התעופה בוונקובר השייכת למחוז קולומביה הבריטית. בפרובינציה זו יש רגישות מיוחדת לאיכות הסביבה ובהתאם לכך הותוותה התוכנית הסביבתית של נמל התעופה. ב-2008 עברה התוכנית שינויים משמעותיים ונקבע טווח של חמש שנים ליישומה, ב-2013. בתוכנית נקבעו חמש עדיפויות אסטרטגיות: הפחתת פליטות, הפחתה של צריכת אנרגיה, הפחתה של ייצור פסולת והגברת המיחזור, שיפור מתמיד של תוכניות ליבה לניהול סביבתי כולל נושא הרעש.

5.1 Dallas/Fort Worth International Airport - USA

Dallas/Fort Worth International Airport 2009 Environmental Management Primer

http://www.dfwairport.com/dfwucm1prd/groups/public/documents/webasset/p1_027449.pdf

Environmental affairs are the gatekeeper of DFW board and ceo's environmental policy & declared standard of environmental excellence.

Environmental Affairs is committed to the principles of sustainability and assuring environmental compliance Airport-wide in furtherance of DFW's priority of fostering

sustainable economic growth and development. Today, DFW Airport has devoted half of its 18,000 acres to operating one of the world’s busiest airports, while at the same time, shepherding 9,000 acres of pristine Natural Resources that reflect the bio-diversity of the North Texas Region.

We consider each of our incremental efforts to prevent pollution, reduce sources of pollution and minimize waste to be important contributions toward meeting our mission deliverables. Acts of environmental stewardship represent an investment in our future and add immeasurably to our collective quality of life.

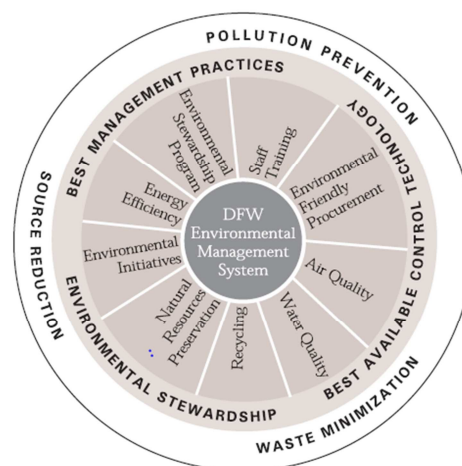
DFW’s Environmental Management System [EMS] was designed and implemented to serve as a platform from which to sustain environmental compliance and achieve a position of environmental leadership in the air transportation industry in response to DFW’s Board and CEO’s directive.

The purpose of this Environmental Primer is to provide a more concise tool for identifying the environmentally regulated aspects of operations, commercial and construction activities conducted on-Airport. The information profiled in these

Use of this Primer as a roadmap to create a written compendium detailing environmentally regulated aspects tailored to your daily tasks will remove any environmental compliance mysticism that may still remain after six (6) years of access to DFW’s EMS. Take this next step now to assure a sustainable Standard of Environmental Excellence at DFW. Your vigilance and stewardship will guarantee continuity of DFW’s environmental integrity.

Thanks to our collective efforts to date, DFW has reached the pinnacle of environmental leadership in the air-transportation industry in this country as acknowledged by both the United States Environmental Protection Agency Administrator and the Executive Director of the Texas Commission on Environmental Quality.

12 Key Elements of EPA’s Compliance-Focused EMS Guidance



One of the most useful and responsive EMS models is the Compliance-Focused Environmental Management System [CFEMS] – Enforcement Agreement Guidance promulgated by EPA’s Office of Criminal Enforcement, Forensics and Training³.

5.2 Gatwick Airport - London

5.2A Gatwick Sustainability Performance Review 2009

Gatwick Airport (2010).

http://www.gatwickairport.com/Documents/business_and_community/Publications/2010/Sustainability%20Performance%20Review%202009.pdf

Gatwick is the country's second largest airport and a major international gateway to the UK. Over the next 10 years we want Gatwick to become London's airport of choice delivering great service to more than 40 million passengers each year. We are committed to sustainable growth through responsible environmental management coupled with strong economic and community programmes. We will build on the strong baseline achieved in 2009 but recognise there are areas for improvement in the future.

2010 has already seen us secure The Carbon Trust Standard for our approach to carbon management as well as ISO14001 certification. This makes us the largest UK airport to achieve both accreditations.

This report also represents the launch of our new environment strategy through to 2020.

"We believe that sustainability means operating and developing the airport in a way that minimises our environmental impacts and maximises the socio-economic benefits for the local community, region and the nation".

A responsible neighbour

We work closely with airlines, stakeholders and business partners to make sure our vision is shared and supported. It is only by developing these relationships that we can achieve our shared ambitions.

Our sustainability priorities

- enabling Gatwick to be the airport of choice for our passengers and customers;
- ensuring the safety and security of our passengers, partners and employees;
- generating national and regional economic wealth, connectivity, increasing airport catchment and employment;
- reducing adverse impacts to the environment;
- building and maintaining constructive relationships with stakeholders; recognising the value of our employees, partners, and communities.

In delivering our sustainability goals we will:

- set clearly defined targets and policies for delivery from today to 2020;
- operate today as efficiently as we can and invest appropriately for the future;
- protect the business and ensure we have appropriate resilience;
- communicate our approach and performance with stakeholders;
- partner with organisations who can help us achieve our goals;
- work with government, industry and regulators to develop policy and plans;
- engage with our community explaining our positive and negative impacts.

Our management priorities

- Our approach to sustainability supports our key management priorities:

- running more efficient operations
- delivering our investment programme more effectively
- establishing our voice as an independent airport
- separating from BAA
- Creating the right organisation and culture needed to succeed.

5.2B. Decade of change – Moving towards a sustainable Gatwick

Gatwick Airport (2010).

http://www.gatwickairport.com/Documents/business_and_community/Publications/2010/Decade_of_change_Aug10.pdf

Environmental management

Our environmental management system (EMS) demonstrates our commitment to continue improving our environmental performance, meet the requirements of our environmental policy and objectives, and the expectations of the community and our regulators. As a result of this robust approach Gatwick is the largest UK airport to attain certification to ISO14001 the international environmental standard.

A low carbon Gatwick - Plans for 2010

- To roll-out Gatwick's low-carbon strategy
- To prepare for Carbon Reduction
- Commitment energy efficiency scheme.
- To attain Carbon Trust Standard
- To work with Sustainable Aviation, ACI & AOA on key policy issues

Managing air quality - Plans for 2010

- To publish a pre-conditioned air feasibility study for Gatwick
- To undertake the 2015 air quality inventory and modelling
- To consult with airlines over NOx reduction targets by the end of 2010
- To fund the borough council's air quality management in line with our 2008 S106 Legal Agreement

Gatwick and noise

We have a robust and detailed noise strategy, established in conjunction with local authority partners, which will be supplemented with the publication of Gatwick's European Noise Directive (END) action plan in 2010. It is important that we continue to gain the trust of our stakeholders and demonstrate best practice to minimize the impacts of aircraft noise.

END Noise Action Plan In November 2009, we submitted a draft action plan to the UK Secretary of State for Environment. The draft included feedback from a 16 week public consultation, during which we spoke to a range of local community representatives, local authorities, government agencies and business partners. It detailed our plans for the next five years to help manage and reduce noise impacts on local communities.

Reducing operational impacts – 2009 performance

Energy consumption: Gas usage reduced by nearly 20% to 54,246MWh. Electricity usage reduced by just over 2% to 159,578 MWh

Waste: We handled 10,177 tonnes of waste, of which 37.9% was either reused or recycled.

Water quality and consumption: Our average Biological Oxygen Demand at D Pond outlet was 19.2 mg/l. Our water consumption was 1,059,141 m³ an increase of less than 1% over 2008.

Plans for 2010

Energy: Reduce our energy consumption by 2% Waste: Increase our waste re-use & recycling levels to 40% Water quality and consumption: Continue with the active repair of leaks and improvement of metering. Construct a new balancing pond that will improve the quality of our surface water discharges.

We have a ten point sustainability plan -10 issues, 10 years. By 2020 we want to: Demonstrate we are a trusted a valued neighbour:

- Work with our partners and make a positive contribution to Gatwick's local communities
- Implement an enhanced community and charitable giving programme
- Increase the educational value of Gatwick across the Gatwick Diamond

Fulfill our role as an economic driver of local, regional and national significance

- Work with government and stakeholders to demonstrate Gatwick's significant economic role for London and the UK economy
- Ensure strategic infrastructure is delivered to enable Gatwick to grow
- Support economic growth in the Gatwick Diamond and local economies

Increase sustainable access options for our passengers and staff

- Increase Gatwick's catchment through better public transport access
- Transform public transport infrastructure and facilities at the airport
- Provide the right car parking facilities, forecourt infrastructure and services supported by an efficient and effective airport road network

Reduce our carbon emissions by 50% (scope 1 & 2 emissions against 1990 baseline)

- Define and implement a low carbon roadmap for Gatwick
- Reduce Energy Consumption by 20% (against 1990 baseline)
- Demonstrate our commitment through investing in innovation, achieving accreditations and delivering compliance and standards

Improve air quality impacts

- Work with airlines and partners to reduce air quality impacts using new technology, processes and systems
- Develop vehicular low emission zone for Gatwick
- Understand the impacts of future legislation for Gatwick and plan accordingly

Reduce the impact of operational noise

- Implement Gatwick's European Noise Directive (END) noise action plan
- Maintain Gatwick's position as 'best practice' for noise management
- Work with airlines and partners to reduce noise impacts on Gatwick's campus

Generate no waste to landfill

- 70% of Gatwick waste recycled
- Work with airlines, partners and stakeholders to deliver a joint approach to waste management

- Embrace innovation to drive improvements to waste management practices
- 8. 20% reduction in energy (against 1990 baseline) and water consumption (against 2010 baseline)
- Investing in low carbon and zero carbon technology
- Empowering our employees to change the way they work
- Working with partners to drive improvements in waste management

20% reduction in energy (against 1990 baseline) and water consumption (against 2010 baseline)

- Investing in low carbon and zero carbon technology
- Empowering our employees to change the way they work
- Working with partners to drive improvements in waste management

Improve the quality of water leaving the airport

- Significant investment to improve infrastructure and resilience
- Strong strategic relationships with the regulator and local authorities
- Implement a new pollution control regime to improve performance
- Have an award winning biodiversity approach
- Have biodiversity action plans for three on-airport sites
- Increase the biodiversity value of the airport
- Increase the educational value of biodiversity

Have an award winning biodiversity approach

- Have biodiversity action plans for three on-airport sites
- Increase the biodiversity value of the airport
- Increase the educational value of biodiversity

5.3 Narita Airport - Tokyo

5.3A Narita Airport - Environment report 2010

Narita Airport.(2010)

http://www.naa.jp/en/environment/pdf_2010/kankyo_report2010.pdf

5.3B Narita Airport: What is Eco Airport?

Narita Airport (2010)

http://www.naa.jp/en/environment/pdf_2010/digest2010.pdf

Narita International Airport is a thriving hub of business activities and services performed by over 500 businesses and organizations including the airlines, freight houses, tenants and government agencies. Narita International Airport Corporation (NAA), as the founder and operator of the airport, develops and improves its facilities, etc., and strives to create a safe, convenient airport for the customers that use it and the people who work there

NAA works in conjunction with a large number of stakeholders to develop a sustainable airport to produce an airport of value with a viable future as the gateway to the skies of

Japan. An eco-airport master plan encompassing the entire airport has been created for Narita International Airport.

Environment Master Policy

NAA will aim to create an environment friendly recycling airport (Eco-Airport) by building on its environmental commitments from a global perspective. It will also contribute to the development of an affluent 21st century society by building on its trust as a member of the community.

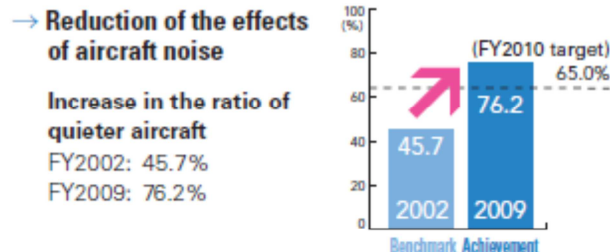
- Actively address environmental issues from a global perspective, controlling the environmental impact from airport construction and operation as well as reducing its effect on the regional environment.
- Formulate basic plans for all business activities for improved environment preservation through strict abidance to environment laws and regulations as well as through regular review of self-imposed targets.
- Set up a system to allow environmental preservation activities to function effectively and make continuous improvements.
- Raise awareness in the entire work force through internal communication on environment issues, and provide education and support so that each individual employee can share in environmental preservation activities.
- Encourage environmental preservation activities as part of the NAA group and extend the activities to airport businesses to promote an environment friendly Eco-Airport as an entire airport.
- Actively disseminate information on environmental preservation activities and maintain close communication with the community, particularly in the surrounding region.

Community Environment Initiatives: There are initiatives for reducing aircraft noise, air pollutants and other environmental impact around the airport. International landing charges based on the Narita airport noise index.

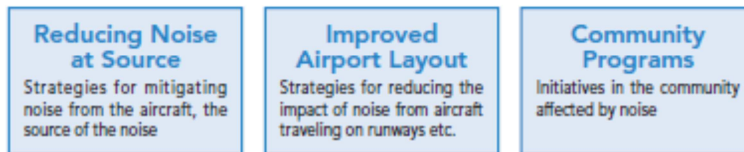
- Reduction of the effects of aircraft noise: Noise mitigation embankments reduce the noise level on by around 10dB

1. Aircraft Noise Mitigation Strategies

Targets and Performance



Besides complying with the Noise Prevention Law*1, the following three noise strategies have been put in place at Narita International Airport so as to further reduce the impact on the community from noise.



- Reducing the impact of air pollution on the community
- Reducing the impact of pollution of rainwater and drainage on the community
- De-icing and snow clearing measures snowy or frosty days. Cleanliness of surrounding waterways is maintained even when using de-icing agent

Global Environment Initiatives: There are also initiatives for reducing the impact on the global environment such as energy conservation and global warming

- Reducing the emission of air pollutants
- Reducing the emission of greenhouse gases: Stop Aircraft Engine Idling! Reduce CO2 Emissions to Less than 10%.
- Improving energy conservation: Actively Introducing LEDs for Airport Lighting

Resource Conservation Initiatives: Efforts are made to reduce waste, recycle and save water, promoting the reuse and recycling of resources used in airport business activities

- Improved recycling of general waste and reducing emission levels
- Water conservation: Making Effective Use of Rainwater and Kitchen Wastewater
- Mowing by the Runway Actually Contributes to Farming - who use it for composting.

Natural Environment Initiatives: Many policies are aimed at airport integration with the community through conservation of the natural environment around the airport and revitalization of the agriculture, etc. International Biodiversity Initiatives: We strive to protect the natural environment that comforts, nurtures and teaches us, and pass it on to

ensuing generations. We are continuing in our earnest efforts to reclaim the natural environment lost by airport construction, make it even better and return it to the community.

- Conservation of the natural environment in the local community
- Support for the revitalization of agriculture in the local community

Improvement of Environmental Communication

- Improved public disclosure
- Closer liaison with airport-related businesses
- Encourage customer involvement
- Interaction with other airports at home and abroad
- Improved communication with the community
- Improved social contribution

Environment Initiatives in NAA Offices

- Reduce air pollutants, greenhouse gas emissions and energy consumption
- Water conservation
- Improved recycling of general waste and reducing emission levels
- Green purchasing

5.4 Vancouver Airport - Canada

2009 Environment Report

<http://www.yvr.ca/ar/2009/pdfs/2009-Environment-Report.pdf>

Environmental Management Plan

The Vancouver International Airport Environmental Management Plan details accountabilities for environmental management initiatives within the Airport Authority; it also describes environmental policies and programs around key sustainability issues overseen by the Airport Authority's Environment Department.

Issues addressed by the plan include:

- Aeronautical noise
- Air quality and climate change
- Contaminated sites
- Environmental impact assessment and sustainable building design
- Hazardous materials
- Natural habitat
- Energy and resources
- Waste
- Water quality

The Environmental Management Plan was reviewed and substantially updated in 2008, spanning a five-year time period from 2009 to 2013. The plan focuses on five strategic priorities for the Airport Authority:

- Reduce emissions

- Reduce energy usage
- Reduce waste generation and enhance recycling
- Implement a communication, awareness, recognition and education program
- Continuous improvement of core environmental management programs including noise management

Details on the initiatives implemented in 2009 that support these priorities are presented in various sections of this report. The Airport Authority revised its Environmental Policy by adopting an integrated policy for safety, security and environment. This overarching policy is an important step in formally integrating the management of these critical risk areas.

Federal standards provide the basis for environmental programs and performance. However, in the interests of responsible environmental management, the Airport Authority works to meet or exceed additional, self-imposed standards including the adoption of applicable provincial and regional requirements. This means that if provincial, regional or municipal guidelines provide pertinent standards, the Airport Authority will endeavour to meet those standards. The Airport Authority also requires tenants on Sea Island to meet the same standards.

To continually improve our environmental performance, the Airport Authority's environmental management system was developed in accordance with the principles of ISO 14001, the internationally recognized standard that outlines the structures of environmental management systems.

6. Wildlife Hazards

כידוע, בישראל נושא ההתמודדות עם ציפורים נודדות הוא קריטי ונערכו עבודות מחקר בשיתוף חיל האוויר וגורמים אזרחיים, שמטרתן הייתה לבדוק את נתיבי נדידת העופות הדואים מעל ישראל, זמני הגעתם, גובה הנדידה ומספרי העופות הנודדים, על מנת לצמצם פגיעות במטוסים. המחקר שבוצע ע"י יוסי לשם הוביל לסימונם של אזורים מוכי ציפורים (אמ"צ) במרחב האווירי של ישראל, בהתאם לכל עונת נדידה. סימונים אלה מסייעים בתכנון נתיבי טיסה המפחיתים במידת האפשר את סיכויי ההתנגשות בין מטוסים לציפורים.

נמלי התעופה ברחבי העולם המתמודדים עם הצורך החיוני לשמר את המגוון הביולוגי ולהמעיט את הרס הסביבה יחד עם הצורך החיוני למנוע תאונות.

בקרב קהיליית התעופה האזרחית בארה"ב יש הכרה בכך שגובר והולך האיום על בטיחות התעופה כתוצאה מתאונות אוויריות שמקורן בהתנגשות עם ציפורים וההשלכות הכלכליות הנובעות מהן. שני גורמים עיקריים אחראים לכך: גידול ניכר בהיקף התעופה האזרחית וגידול במגוון העופות המערבים בתאונות אוויריות. בפרק זה מופיע תקציר של מדריך חדש מ-2010 שהוצא לאור על ידי ACRP (Airport Cooperative Research Program) להתמודדות עם הסכנות של בעלי חיים ולא רק עופות. הנמצאים באזור שדה התעופה.

התייחסות נוספת ניתן למצוא בדוחות של שדות התעופה השונים כמו נמל התעופה וונקובר.

ACRP - Guidebook for Addressing Aircraft/Wildlife Hazards at General Aviation Airports

ACRP Report 32 (2010)

http://onlinepubs.trb.org/onlinepubs/acrp/acrp_rpt_032.pdf

Guidebook Purpose and Design

This guidebook specifically addresses the following issues:

- Identifying hazardous wildlife, the problems they cause at general aviation (GA) airports, and methods for dealing with those problems; and
- Establishing wildlife hazard control programs at GA airports, evaluating the effectiveness of a wildlife hazard control program, and training airport personnel.

Introduction to the Problem

The January 15, 2009, crash landing of US Airways flight 1549 in the Hudson River following ingestion of Canada geese into both of the plane's engines graphically illustrates the importance of wildlife aircraft strike hazard management. The incident also raised the public's awareness of the threat to aviation safety posed by wildlife at or near airports. For the first time, many people both in and out of the aviation community have become aware that birds can bring down an aircraft. However, this threat is not new. The first recorded bird strike occurred September 7, 1905, and the first recorded human death due to a bird strike occurred April 3, 1912.

Experts within the civil aviation community have long recognized that the threat to aviation safety and economic repercussions from collisions between aircraft and wildlife (commonly referred to as "wildlife aircraft strikes" or "strikes") is increasing (see for example Dolbeer 2000, Allan and Orosz 2001, MacKinnon, Sowden, and Dudley, 2001, Dolbeer and Eschenfelder 2003, Cleary and Dolbeer 2005, and Cleary et al. 2007).

Several factors contribute to this increasing threat. **The two most significant factors are:**

1. There are a large number of GA aircraft and a high number of hours that GA aircraft are flown. GA aircraft account for approximately 75% of the U.S. civil aircraft fleet (The National Economic Impact of Civil Aviation 2002). GA air traffic has remained fairly steady over the last several years. Between 1991 and 2005, GA aircraft flew an average of 25.8 million hours per year. This ranged from a low of 22.2 million hours flown in 1994 to a high of 29.1 million hours in 2000 (Nall Report Accident Trends and Factors for 2000, Nall Report Accident Trends and Factors for 2005).

2. Populations of many wildlife species commonly involved in wildlife aircraft strikes are increasing. For example, white-tailed deer populations increased from a low of 0.3 million in 1900 to a conservatively estimated 20 million in 2006 (McCabe and McCabe 1997, Dolbeer personal communication 2008). The non-migratory Canada goose population quadrupled in the United States between 1986 and 2002 (Sauer et al. 2006).

Between January 1, 1990, and December 31, 2008, wildlife strikes caused damage to 10,352 U.S. civil aircraft; 2,700 of the strikes caused substantial damage, and 49 U.S. civil aircraft were destroyed due to wildlife strikes. Of the 49 strikes that resulted in loss of the aircraft, 33 (67%) occurred at a GA airport.

Between January 1, 1990, and October 31, 2008, the FAA received 72 reports of wildlife strikes involving GA aircraft that resulted in 87 human injuries. During the same period, the FAA received six reports of wildlife strikes involving GA aircraft that resulted in 13 human deaths.

All airports—GA and commercial—have a legal responsibility to provide a safe aircraft operating environment. This includes controlling hazardous wildlife problems as well as assigning, marking and lighting, and removing ice and snow where required.

In the United States, most funding, research, and regulatory efforts directed toward addressing the civil aviation wildlife strike problem come from the federal level, specifically the FAA. Congress has not given the FAA authority to inspect or license GA airports. Most of the FAA's wildlife hazard research efforts are directed toward certificated airports. Little, if any, work has been done to analyze and understand the hazardous wildlife problems faced by the GA community.

This guidebook presents information for airport personnel responsible for the day-to-day operations of a GA airport's wildlife hazard control program. It also provides guidance for GA airport operators trying to develop and manage a wildlife hazard control program at their airport.

Applicability

Throughout this document reference is made to various federal regulations, in particular Title 14 Code of Federal Regulations Part 139, Certification of Airports (14 CFR 139), and Federal Aviation Administration Advisory Circulars that deal with managing hazardous wildlife at or near airports. (See Appendix C for a list of applicable ACs.) It is recognized that GA airports are not bound by Part 139. However, many states use 14 CFR 139 and FAA Advisory Circulars as the basis of their civil aviation regulations. GA airport managers may find it beneficial to be familiar with these regulations and ACs. Airports that have accepted Airport Improvement Program (AIP) monies or other federal grants-in-aid (obligated airports) are bound by the Airport Grant Assurances, particularly,

Assurance 19, Operation and Maintenance; Assurance 20, Hazard Removal and Mitigation; and Assurance 21, Compatible Land Use.

These three Assurances have a direct bearing on addressing hazardous wildlife problems at a GA airport. Also, FAA AC 150/5200-33, Hazardous Wildlife Attractants on or near Airports, was added to the FAA Airport Improvement Program's list of Grant Assurances in July 1999. Therefore, obligated GA airports are bound by the AC requirements. Non-obligated GA air

ports may also find these recommendations helpful for dealing with wildlife problems.

The FAA lacks congressional authority to issue operating licenses or to inspect GA airports.

Inspection and licensing of GA airports is a state responsibility. An obligated airport's requirement to meet all applicable Airport Grant Assurances and Advisory Circulars is a contractual obligation. It is not a regulatory requirement. GA airports that do not meet the Airport Grant Assurances can be found to be "in noncompliance with the Grant Assurances." This is a breach of contract, not a violation of federal law or regulation.

7. Coordination of Civilian-Military Air Traffic Management

שילוב תעופה אזרחית ותעופה צבאית הוא נושא בעל חשיבות מיוחדת בישראל. הנושא מעסיק גם מדינות נוספות ונידון במסגרות בינלאומיות ובכנסים. כנס במסגרת ICAO באוקטובר 2009 עסק בשאלה של הכרה בצרכים של כל אחד מהצדדים, מבלי לפגוע ביעדים של כל צד. באירופה, נידון הנושא במסגרות שונות כמו הפרלמנט האירופי, דיונים ב-Eurocontrol, נושא השילוב חשוב גם במסגרת המשא ומתן לקראת יישום "שמיים פתוחים". באירופה מגדירים את התעופה הצבאית כ- "אחת מחברות התעופה הגדולות" הפעילות ביבשת ומצוין מספר גדול מאוד של כלי טייס צבאיים פעילים הכוללים: מעל 1100 מטוסים גדולים המשמשים להטסות אנשים, מטענים, תדלוק וכד'; 3300 מטוסי קרב; 2300 מטוסים קלים להדרכה ולשימושים שונים; כ-4500 מטוסים צבאיים, המעידים על היקף הפעילות הצבאית.

בעבודה נסרק היקף נרחב של מסמכים העוסקים בנושא השילוב של תעופה ואזרחית ותעופה הצבאית במרחב האווירי. ברשימה הביבליוגרפית מוצג מדגם של מסמכים. רוב רובם של הכנסים והדיונים העוסקים בנושא זה מתרכזים בתחומים כגון: תיאום בתחום פיקוח אווירי, מסלולי טיסה, Search and Rescue ובנושאים מבצעיים. אולם לא נמצאה התייחסות ממשית לנושא איכות הסביבה ובמידה שהנושא מוזכר, ההתייחסות היא מזערית עד אפסית. בעיה זו הוצגה לנציגי רשות התעופה האזרחית בשלבי הדיונים המשותפים. יתכן שנדרשת כאן התמקדות נפרדת.

8. Summary

מבוא

רשות התעופה האזרחית פנתה למוסד שמואל נאמן בטכניון בבקשה להכין סקר ספרות בנושא "תעופה ירוקה".

מטרת העבודה הייתה לערוך סקר ספרות, כדי לאתר נושאים רלוונטיים הנידונים והנחקרים בתחום המוגדר כ"תעופה ירוקה" ולסווגם על פי תחומים. כמו כן, הושם דגש על התפתחויות בעולם הקשורות לנושאים סביבתיים בתעופה. לאחר השלמת הסקר וניתוח הממצאים, הוצגו הנושאים העשויים להיות רלוונטיים למדינת ישראל ולטיפול רשות התעופה האזרחית.

נושא "התעופה הירוקה" מרכז סביבו בשנים האחרונות תשומת לב רבה. הדבר בא לידי ביטוי בכנסים בינלאומיים ואזוריים, בעבודות ובפרסומים רבים שמבוצעים על ידי קשת רחבה של מרכיבי ענף התעופה הכוללים בין השאר: ארגונים ומוסדות בינלאומיים העוסקים בתחום התעופה ואיכות הסביבה, גופים רגולטורים במדינות השונות, יצרני מטוסים, חברות תעופה, נמלי אוויר וגופי מחקר.

בשלב הראשון של העבודה נערך סקר ראשוני רחבי ונסרקו מספר גדול של עבודות, מחקרים ופרסומים במגוון רחב של תחומים. לאחר ניתוח החומר, נערך מיון והוגדרו 14 תת נושאים:

Alternative fuel, Fuel efficiency, Emission policy and EU Emissions Trading Scheme, Aircraft noise, Green airports, Recyclable materials, Eco-design, Green regional aircraft, Green rotor craft, Sustainable and green engine, Sustainable and green engine, Smart Fixed Wing Aircraft, Environmental Management System, Diffusion of diseases and Danger of birds.

לאור המגוון הגדול והתחום הרחב של הנושאים, נקבע, בתאום עם נציגי רשות התעופה בישראל, להתרכז בשני נושאים עיקריים הרלוונטיים לישראל: מדיניות תעופה ירוקה בארצות נבחרות. וניהול נושאי הסביבה בנמלי תעופה. שני נושאים אלו הם ברמת השליטה וההשפעה של המדינה ושל הגורמים האחראים, במיוחד רשות שדות התעופה.

במקביל, הומלץ להתייחס לשני נושאים מוגדרים יותר בהיקפם: האחד עוסק בטיפול הבינלאומי בהיבטים סביבתיים של השילוב האינטנסיבי של תעופה אזרחית ותעופה צבאית במרחב אווירי מוגדר והשני עוסק בסכנות הנובעות מציפורים במרחב האווירי, במיוחד באזור שדות התעופה.

בכל אחד מהנושאים לעיל הובאו תקצירים של מבחר מסמכים ומאמרים עדכניים המלווים במראי מקום ורשימה ביבליוגרפית של מקורות ואתרים המאפשרים הכרות רחבה יותר עם הנושאים הנידונים. למרות ההתרכזות בנושאים הרלוונטיים יותר לישראל, ראוי לציין, שחלק ניכר מ-14 תת-הנושאים, זוכים להתייחסות במסגרת תקצירי המאמרים והביבליוגרפיה. בראש כל פרק ישנו תקציר בעברית המרכז את תחומי הדיון ומפנה את הקורא למסמכים הנכללים בדו"ח ומציין קישוריות רלוונטיות לנושא הנידון. בנוסף, ניתן למצוא הפניות למסמכים נוספים שלא נסקרו בעבודה, ברשימה הביבליוגרפית בפרק 9.

נושא "תעופה ירוקה" הוא דינמי מאוד. חלק מהפרסומים חוזר ומופיע על בסיס שנתי. לפיכך, עם הופעת פרסום מעודכן, נמחק לעיתים העותק הקודם. יש אם כן, להקפיד לקרוא את הגרסה המעודכנת. בעבודה זו נכללו כבר תקצירים של פרסומים, שיצאו לאור כבר ב-2011 והחליפו גרסאות משנה קודמת.

תעופה ירוקה – מדיניות, הניסיון הבינלאומי

הפרק מתייחס לנושאים של מדיניות תעופה ירוקה ברמה גלובלית (ICAO) וברמה האזורית (ארה"ב). הנושא שעלה דרגה בחשיבותו במסגרת הכינוס האחרון של האו"ם שנערך בקנקון, מקסיקו בדצמבר 2010, הוא מדיניות "שינויי האקלים". בכנס זה הועלה נושא זיהום האוויר ופליטת גזי חממה בשני אמצעי תעבורה מרכזיים - התעופה והספנות. במסמך שהוצג בכנס, מפורטת המדיניות העולמית של 190 מדינות חברות לגבי הפחתה של פליטת גזי חממה בתעופה. בין הנקודות העיקריות, סוכם שרמת

פליטת CO2 תישאר ברמתה הנוכחית עד 2020, למרות הגידול המשמעותי בהיקף הפעילות בענף התעופה. כן נקבע גם היעד לשיפור של יעילות צריכת הדלק בשני אחוזים לשנה עד 2050.

בדף הבית של ארגון FAA בנושא הסביבה (מסמך 2.2), מפורטת רשימת הנושאים הכלולים במסגרת המדיניות כגון פליטות ממנועי המטוסים, רעש ואיכות האוויר. דף הבית נותן מבט תמציתי על מדיניות התוכנית של מערכת התעופה בארה"ב המאפשרת פיתוח תעופה בת קיימה, תוך הקפדה על בטיחות הטיסה ויעילותה. שלושת היעדים המרכזיים בתוכנית זו ל-2018 הם: הפחתה מצטברת של CO2 של 14 מיליון טון, הורדה של 1.4 מיליארד גלון של דלק וצמצום העיכובים בטיסות בהיקף של 21 אחוז. בהמשך צורפו שתי הפניות למיזם חדש של הארגון מ-2010 (NextGen Vision) המפרט את תפיסת ה-FAA בהתמודדות עם נושאי איכות הסביבה בתעופה בד בבד עם המשך פיתוח ענף תעופה.

נושא התעופה והסביבה נידון בהרחבה באיחוד האירופי. חמישה מסמכים והפניות מציגים את מרכיבי המדיניות. של האיחוד האירופי בתחומים של תחבורה, הפיכת כל אירופה לשמיים פתוחים, שינוי אקלים והפחתת פליטות לצד היבטים מחקריים וטכנולוגיים. המסמך המרכזי (2.4) מפרט את התפיסה הכללית של מדיניות תעופה ואיכות הסביבה באיחוד האירופי. הדיון מתמקד בשני נושאים מרכזיים: רעש הנגרם על ידי מטוסים ופליטת גזי חממה. הנושא הראשון מתרכז בעיקר סביב שדות התעופה ולנושא השני יש השלכות מקומיות על איכות האוויר ובמקביל גם השפעות גלובליות בתחום שינוי האקלים. מסמך שנערך על ידי ה-TRB האמריקני מציג נושאים קריטיים נוספים מעבר לנושא הרעש ופליטת גזי חממה כמו דלק חלופי, קיימות, פיתוח טכנולוגי, צריכת אנרגיה, פליטות בשדות התעופה ומודלים של מחקר בתחום הסביבה.

נושאים אלה הופכים משמעותיים יותר ויותר ככל שהיקף הפעילות האווירית הולך וגדל. ההערכה היא כי פעילות התעופה אחראית ל-2-3 אחוזים מסך כל הפליטות של CO2 והתחזית היא שמרכיב זה יעלה ל-4 אחוז ב-2050. היקף התעופה באירופה צפוי לגדול במהלך השנים הבאות בקצב של 4-5 אחוז בשנה והיקף פליטות גזי חממה ימשיך לעלות, למרות השיפורים הטכנולוגיים כמו הפחתת שריפת הדלק לנוסע. לצורך התמודדות עם הבעיה מתמקדת מדיניות האיחוד בשלושה כיוונים: מחקר ופיתוח של "טכנולוגיה ירוקה" במסגרת התוכנית השביעית במטרה להפחית פליטת של CO2 ו-NOX, פיתוח מערכות מודרניות של ניהול תעופה ובמיוחד קביעת רפורמה של שמיים אירופיים פתוחים (SES ויוזמת SESAR). הכיוון השלישי הוא נקיטת אמצעים המבוססים על מבוססים על ETS (תוכנית המסחר בפליטות גזי חממה) כמפורט במסמכים המצורפים.

עם היווצרות שוק תעופה אחד במסגרת האיחוד האירופי, מתפתחת המסגרת הרגולטורית. על מנת להנגיש את החוקים ולהקל על הקריאה בהם, פותח המדריך לתעופה האזרחית הכולל שלושה חלקים: החלק הראשון עוסק ברגולציות והוראות; החלק השני עוסק בהחלטות, מקרים משפטיים וחוקים תחרותיים; החלק השלישי מאגד הסכמים בינלאומיים.

תוכנית מרכזית במדיניות התעופה האירופית היא SESAR. המדיניות הסביבתית של SESAR היא לצמצם את ההשלכות הסביבתיות בעשרה אחוז לכל טיסה בלי לפגוע בבטיחות וביעילות הכלכלית. היעדים של התוכנית נחלקים לטווחים קצרים (2009-2011) ולטווחים ארוכים יותר עד 2020 ועיקרם: שיפור תפקיד ניהול מערכות התעופה בפיתוח תקנות סביבתיות ואכיפתן ברמה האירופית בנושא רעש ופליטות גזים.

ניסיון מעניין לשלב בין המדיניות האמריקאית NextGen והתוכנית האירופית SESAR מוצג בפרויקט AIRE, שהוא פועל יוצא משיתוף פעולה של הנציבות האירופית וה-FAA. התיאומים הללו כוללים, בין השאר, את נושאי ההסעה על המסלולים, שדות התעופה, טיסות טרנס-אטלנטיות וצוואר הבקבוק שנוצר בשדות התעופה.

נקודת מבט נוספת שראויה להתייחסות היא מדיניות המשתתפים החשובים של תעשיית התעופה העולמית, כמו יצרניות המטוסים והמנועים, בנושא פיתוח תעופה בת קיימה המוצגת אף היא בפרק זה.

שדות תעופה "ירוקים"

הנושא המרכזי הרלוונטי למדינת ישראל כולל מגוון תחומים העוסקים בשדות תעופה ירוקים. נושא זה נמצא באחריות רשות התעופה האזרחית במשרד התחבורה, המשרד להגנת הסביבה ובשליטה של מדינת ישראל.

הדיון נחלק שלושה חלקים: החלק הראשון בפרק 3, עוסק במדיניות, תקנות, תכנון של שדות תעופה ותפעולם אל מול אתגרי טביעת הרגל הסביבתית שלהם. פרק 4 מוקדש לנושא איכות האוויר בסביבות שדות התעופה, שמקורו במטוסים ובפעילות מתקני שדה התעופה. פרק 5 מביא דוגמאות נבחרות של שדות תעופה בארה"ב, קנדה, אירופה ויפן המציגות את הבעיות הספציפיות של שדות התעופה.

א. תקנות, מדיניות ורגולציה

תקצירי המסמכים בפרק זה ממקדים את המדיניות הכוללת של תעופה והסביבה כפי שהיא משתקפת במרחב שדה התעופה עצמו. האתגרים בתחום תשתיות פיזיות בשדות התעופה מוצגים במסמך של-ACI Europe. לטענת ACI, הממשלות אינן ששות להשתתף בעלויות התפעול של שדות התעופה וחברות התעופה ואינן משלמות את מלוא העלות על השימוש בתשתיות. נמלי האוויר נאלצים להתבסס, במידה רבה, על מימון ציבור המשתמשים לתפעול והתמודדות עם האתגרים הסביבתיים כמו רעש. מוצגים ארבעה אתגרים: קיבולת שדות התעופה, אתגרי השמירה על הסביבה, אתגרי הנגישות לשדות התעופה והבטיחות. בשונה משאר העולם, נושאים נמלי אוויר באירופה ברוב העלויות ולא זוכים למימון ציבורי נרחב ובמסמך עולה השאלה של מעורבות הממשלות בהתמודדות עם האתגרים הללו. מסמך חשוב בנושא מדיניות איכות הסביבה בנמלי התעופה האירופיים הוא מדריך ליישום שיתוף פעולה בנושאים של ניהול סביבתי מתואם של כל המפעילים השונים המעורבים בשדה התעופה וסביבתו.

המסמך, NEPA Implementing Instructions for Airport Projects, מציג את החוק האמריקני המתייחס לדרישות הסביבתיות לגבי תפעול שדות התעופה תחת סמכות ה-FAA. החוק הוא חלק ממאמצי ה-FAA לתת הנחיות ברורות להתמודדות עם ההשפעות הסביבתיות הנוצרות כתוצאה מהפעילויות העיקריות בשדות התעופה.

העבודה מציגה מדריך מעשי (Desk Reference) ליישום החוקים הסביבתיים השונים בשדות התעופה. המדריך כולל, בין היתר, פרקים על אישורים ורישיונות, יישום החוקים בפיתוח שדות התעופה ותכנים של סקר ההשפעה על הסביבה. מסמך נוסף מתעד שיטות מעשיות (סביבתיות, כלכליות וחברתיות) לקיימות בשדות התעופה. על בסיסם נבנה שאלון שנשלח ל-52 שדות תעופה בארה"ב ומחוצה לה. התשובות שנתקבלו מ-25 מהם מתעדות, למעשה, תפעול בר קיימה של שדות התעופה בצומת של כלכלה, חברה וסביבה.

במהלך שנות התשעים של המאה העשרים, גרמה תנופת הגידול בתנועה האווירית לביקוש גובר של קיבולת בשדות התעופה. פיתוח זה גרם, לעיתים קרובות, לקונפליקט קשה בין הצורך להרחיב את השדות ובין הדרישות הסביבתיות הנדרשות מצד אחד והתושבים המתגוררים בשכונות, מצד שני. במקרים רבים, גרם הדבר לעיכובים רבים ולעצירת הפיתוח של שדות התעופה. כדי להתגבר על הבעיה קודם מיזם GAI, שמטרתו הייתה לאפשר פיתוח נמלי אוויר בשילוב עם עמידה בדרישות הסביבתיות, תוך צמצום הקונפליקטים עם האוכלוסייה. המיזם הגדיר את "טביעת הרגל" הסביבתית של שדה התעופה מתוך כוונה להקים שדות תעופה ירוקים יותר. המיזם של ה-GAI מאפשר לפתח אופציות של עלות-תועלת המצמצמות את התלונות של השכנים על ידי כך שהמיזם משמש כמייצג באופן מקביל את היעדים התפעוליים והקהילה השכנה.

ב. איכות הסביבה – אוויר, קרקע ומים

שדות תעופה באירופה מתמודדים מזה עשרות שנים ברמה המקומית עם אתגרים סביבתיים, בעיקר של איכות האוויר, זיהומי קרקע, איכות המים וסכנות זיהום של מקורות מים. אולם התפתחות הדיון בשינויים אקלימיים ברמה הגלובלית הוסיפו מימד חדש להתמודדות זו. שדות התעופה נדרשים לעמוד בדרישות הולכות ומחמירות להוכיח את התאמתם למדיניות סביבתית ולתקנותיה הקשורות להשפעות מעבר לסביבה הקרובה.

לצורך התמודדות עם איכות האוויר בשדה התעופה וסביבתו נכתב המדריך של ICAO הכולל פרקים על המסגרת הרגולטורית למדידת איכות האוויר, מדידת הפליטות והטיפול בהן. מטרת המדריך היא לתת עצות מעשיות ומידע המבוסס על שיטות שנוסו בהתמודדות עם הבעיה. במדריך יש הנחיות כיצד לייסד הליכים המתאימים ביותר לגישת המדינות השונות ומוצגת מסגרת אנליטית המגדירה את השיטות הטובות ביותר לצרכים שונים או לתרחישים אפשריים. בהמשך מוצגת המסגרת שלפיה המדריך מציג את ההנחיות כיצד להעריך את איכות האוויר – רגולציות המעודדות תקינת סטנדרטים למקורות פליטה ולהגדרת הליכים שיתאימו לרגולציות.

ביוזמת ACI-EUROPE, אומצו אמות מידה מוגדרות לפליטות וב-2009 פותחה הסכימה של Airport Carbon Accreditation. הבדיקה של נמלי התעופה והאקרדיטציה שלהם נעשית בכל שנה ומופעלת על ידי חברת ייעוץ המתמנה על ידי ACI-EUROPE. זהו כלי וולונטרי המסייע לצרף את שדות התעופה כציר מפתח בתחום התעופה למאמץ לקראת קיימות. כך, שדות התעופה נהנים משורה של יתרונות כלכליים ותדמיתיים המקלים עליהם, בין השאר, להמשיך ולפתח את התשתיות באמצעות זכייה ב"אישור לגדול", בתמורה לגישה האקטיבית שלהם לצמצום פליטות.

העבודה מציגה יוזמה משותפת של ארה"ב וקנדה לצמצום הפליטות באזורי שדות התעופה. ב-325 שדות תעופה נמדדו ההשפעות של פעילותם על האזורים הסמוכים להם. המדידות התייחסו לפליטות בהליכי הפעלת המנועים ליד השערים, הסעה אל המסלולים, המראות, יציאה מאזור שדה התעופה והנחיתות. הנתונים מאפשרים לימוד ההשפעה של פעילות שדה התעופה על האזורים הסמוכים, ומשמשים תמריץ להגדלת היעילות בצריכת הדלק, בתפעול מטוסים בשדה התעופה ובצמצום הפליטות.

מסמך שנכתב ב-2010 על ידי משרד הקיימות והסביבה האוסטרלי, הוא מדריך לשיטות מעשיות לשימוש יעיל במים. הבטחת מקורות מים עצמאיים ומובטחים הם חלק חשוב מכל פעילות סדירה של שדה התעופה. מים משמשים לניקיון ותחזוקה של מטוסים, לטיפול במכוניות להשכרה, לשטחים ירוקים, לשירותי הסעדה ואירוח, שירותים, מגדלי קירור ועוד. בשדות התעופה מתמודדים עם בעיות של נגר עילי, איכות מים, בעיות סחיפה וזיהום קרקע, נזילת מים ממבנים ישנים ועוד. לכן יש צורך ליישם תוכניות לניהול בר-קיימה של מים כחלק מאסטרטגיה סביבתית כוללת.

שני מסמכים מציגים התייחסות למרכיבים נוספים של איכות הסביבה באזורי נמלי תעופה. האחד מציג את האסטרטגיה הסביבתית של נמל התעופה מתייחס, בין היתר, לנושא של מניעת זיהום קרקע ומי תהום הנגרם בשל מגוון הפעילויות הרחב של שדה התעופה. המסמך השני עוסק בניהול פסולת תעשייתית בשדות התעופה ומתייחס ספציפית להנחיות ולחוקים כיצד להתמודד עם מי הביוב שנוצרים מפעילות שדה התעופה.

ג. שדות תעופה נבחרים – מקרי בוחן.

בפרק זה מוצגים ארבעה שדות תעופה במדינות שונות המתמודדים עם אתגרי הסביבה והקיימות אל מול הרצון להמשיך פיתוח וצמיחה. בנוסף, יש הפניות לשמונה שדות תעופה נבחרים ברשימה הביבליוגרפית. מעיון בעבודות שנעשו בשדות התעופה הללו, ניתן ללמוד רבות על ניסיונות, גישות ודגשים בעיצוב תוכניות ניהול סביבתיות ויישומן.

הנהלת שדה התעופה Dallas/Fort Worth, גיבשה תוכנית לניהול נושאי סביבה, שעיקרה 12 מרכיבי מפתח המבוססים על הנחיות המשרד להגנת הסביבה (EPA). שלושה צירים מרכזיים מנחים את התוכנית: מניעת זיהום, צמצום מקורות הזיהום והפחתת פסולת. המחויבות הכוללת של כל הגורמים המפעילים את שדה התעופה הביאה להכרה בעמדת המנהיגות בנושא תעופה-סביבה בארה"ב, כפי שהוכרו על ידי המחלקות לאיכות הסביבה בטקסס והרשויות הפדראליות בארה"ב.

בנמל התעופה Gatwick, הוכנה תוכנית אסטרטגית סביבתית לעשר השנים הבאות. הגישה בשדה התעופה היא לממש את מחויבותו לשמירת סטנדרטים סביבתיים גבוהים ובמקביל, לראות בכך כלי שעשוי לסייע בתחרות כשדה הנבחר של לונדון. שדה התעופה יצר קשר עם כל הגורמים הפועלים בשדה כדי לוודא שהיעד הסביבתי ממומש על ידי כולם. התוכנית האסטרטגית כוללת אמצעים לצמצום הפליטות,

הפחתת הרעש, הפחתת ההשפעה של גורמי התפעול בנמל התעופה בצריכת אנרגיה, בכמות הפסולת, באיכות המים וצריכתם. התוכנית מפרטת עשרה יעדים להגשמת המדיניות ויישום התוכנית הסביבתית.

תוכנית אב של נמל התעופה Narita ביפן הושלמה ב-2010 תחת הכותרת Eco Airport. הגישה בשדה תעופה זה מאמצת יוזמות אקטיביות מתוך פרספקטיבה גלובלית לצד פיקוח הדוק על ההשפעה האזורית של שדה התעופה ולכן לדוגמה, ההתמודדות עם הרעש עומדת במקום הראשון. לשם המחשה, אגרות הנחיתה מתבססות על אינדקס רעש, שאומץ על ידי שדה התעופה. לאור הלחצים הגדולים של תושבי הסביבה. חלק חשוב מן התוכנית כולל שיתוף פעולה עם הקהילה.

נמל התעופה בונקובר, פועל במחוז קולומביה הבריטית בה קיימת רגישות מיוחדת לאיכות הסביבה. בהתאם לכך הותוותה התוכנית הסביבתית של נמל התעופה. ב-2008 עברה התוכנית שינויים משמעותיים ונקבע טווח של חמש שנים ליישומה בין השנים 2009 ל-2013. בתוכנית נקבעו חמש עדיפויות אסטרטגיות: הפחתת פליטות, הפחתה של צריכת אנרגיה, הפחתה של ייצור פסולת והגברת המחזור, שיפור מתמיד של תוכניות ליבה לניהול סביבתי כולל נושא הרעש.

תעופה ונושא הציפורים

כידוע, בישראל ההתמודדות עם ציפורים נודדות היא קריטית. לכן נערכו עבודות מחקר בשיתוף חיל האוויר וגורמים אזרחיים, שמטרתן הייתה לבדוק את נתיבי נדידת העופות הדואים מעל ישראל, זמני הגעתם, גובה הנדידה ומספרי העופות הנודדים, על מנת לצמצם פגיעות במטוסים. המחקר שבוצע על ידי יוסי לשם הוביל לסימונם של אזורים מוכי ציפורים (אמ"צ) במרחב האווירי של ישראל, בהתאם לכל עונת נדידה. סימונים אלה מסייעים בתכנון נתיבי טיסה המפחיתים, במידת האפשר, את סיכויי ההתנגשות בין מטוסים לציפורים.

נמלי התעופה ברחבי העולם מתמודדים עם הצורך החיוני לשמר את המגוון הביולוגי ולהמעיט את הרס הסביבה יחד עם הצורך החיוני למנוע תאונות.

בקרב קהיליית התעופה האזרחית בארה"ב יש הכרה בכך, שגובר והולך האיום על בטיחות התעופה בגלל התנגשויות מטוסים עם ציפורים וההשלכות הנובעות מהן. שני גורמים עיקריים אחראים לכך: גידול ניכר בהיקף התעופה האזרחית וגידול במגוון העופות המעורבים בתאונות אוויריות. בפרק זה מופיע תקציר של מדריך חדש מ-2010, שהוצא לאור על ידי ACRP להתמודדות עם הסכנות של בעלי חיים ולא רק עופות הנמצאים באזור שדה התעופה. התייחסות נוספת ניתן למצוא בדוחות של שדות התעופה השונים כמו נמל התעופה וונקובר.

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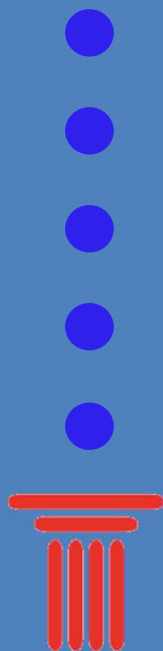
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10. Abbreviations

AC	Advisory Circulars
ACI	Airports council international
ACI-Europe	Airports council international Europe
ACRP	Airport Cooperative Research Program
AGF	Advisory Group on Climate Change Financing
AIRE	Atlantic Interoperability Initiative to Reduce Emissions
AOA	Airport Operators Association
APUs	Auxiliary Power Units
ARP	FAA's Office of Airports
ATAG	Air Transport Action Group
ATC	Air traffic Control
ATM	Air Traffic Management
BCSD	World Business Council for Sustainable Development
CAAFI	Commercial Aviation Alternative Fuels Initiative
CAEP	Committee on Aviation Environment Protection
CDA	Continuous Descent Approaches
CEQ	Council on Environmental Quality
CFEMS	Compliance – Focused Environmental Management System
CFR	Code of Federal Regulations
CLEEN	Continuous Lower Energy, Emissions and Noise
CO	Carbon Monoxide
CO2	Carbon Dioxide
EA	Environmental Assessment
EIS	Environmental Impact Statements
END	European Noise Directive
EMS	Environmental Management System
EPA	US Environmental Protection Agency
ETS	Emissions Trading Scheme
FAA	Federal Aviation Administration
GA	General Aviation
GAI	Green Airport Initiative
GHG	Greenhouse Gas

GSE	Ground Support Equipment
HFC	Hydro-Fluoro-Carbon
IATA	International Air Transport Association
ICAO	International Aviation and Climate Change
IPCC	Intergovernmental Panel on Climate Change
JPDO	Joint Planning and Development Office
LTO	Landing and Take-Off
NAA	Non-Attainment Area
NAAQS	National Ambient Air Quality Standards
NEPA	National Environmental Policy Act
NOX	Nitrogen Oxides
RNP	Required Navigation Performance
SES	Single European Sky
SESAR	Single European Sky ATM Research
TRB	Transportation Research Board



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