ICANA 2013

Dokumentation der zweiten internationalen Konferenz Aktiver Schallschutz

30.-31. Oktober 2013, Hotel Hilton, The Squaire Flughafen Frankfurt

Inhalt

1 Vorwort Herr Lanz

Die Bedeutung des aktiven Schallschutzes für die Regionen um große Verkehrsflughäfen hat in den letzten Jahren, noch einmal im Zeitraum nach der ersten Konferenz im Jahr 2010, zugenommen. Das Belästigungsempfinden der Anwohner ist erheblich angestiegen, gerade neu Betroffene aber auch Menschen, die bereits unter Fluglärm leiden und eine Zunahme der Belastung befürchten artikulieren ihren Protest und Widerstand.
Technische, organisatorische und verfahrensbestimmende Möglichkeiten zur Reduzierung der Fluglärmbelastung benötigen jedoch, anders als vielleicht in anderen Verkehrslärmbereichen, erheblich längere Realisierungszeiträume. Denn der Luftverkehr hat berechtigterweise extrem hohe Anforderungen an die Sicherheit. Technische Entwicklungen sind aufwändig, Nachrüstungen bestehender Technik oder der Austausch von Flotten gegen neuentwickelte, leisere und umweltfreundlichere Flugzeuge sind kostenintensiv und brauchen wegen der langen Betriebszeit der Maschinen lange Zeiträume.
Ziel der Konferenz war es, Fortschritte im aktiven Schallschutz in Frankfurt aber auch darüber hinaus vorzustellen, Einblicke in die aktuelle Forschung sowie die Ziele und Prioritäten von Airlines wie Herstellern kennenzulernen.
Das starke Interesse an der Konferenz, den Vorträgen und den Diskussionen im Plenum wie auch in Einzelgesprächen am Rande der Konferenz haben gezeigt, dass diese Ziele erreicht werden konnten. Mehr noch, am Ende standen erste konkrete Kooperationen zwischen Akteuren, die auf der Konferenz präsentierten.
Die Vorträge sind auf Dauer online als Videos nachvollziehbar, zusätzlich dient diese Dokumentation als Referenz und Nachschlagewerk.
Wir – das Team des UNH – bedanken uns auf diesem Wege noch einmal bei allen Mitwirkenden für den reibungslosen Konferenzablauf und bei allen für die überaus positiven Rückmeldungen, die wir zur Konferenz erhalten haben.

2 Veranstalter

2.1 Forum Flughafen und Region

Das Forum Flughafen und Region (FFR) wurde im Jahr 2008 gegründet und führt den Dialog zwischen der Luftverkehrsseite und den Kommunen und Anwohnern, der in der Mediation und im Regionalen Dialogforum begonnen wurde, weiter. Der Vorstand des FFR besteht aus einem Vertreter der Luftverkehrsseite (Vorstandsmitglied der Fraport AG Peter Schmitz), einem Vertreter der Kommunalen Seite (Landrat des Kreises Offenbach Oliver Quilling) und einem neutralen Vertreter (Vorstandsvorsitzender des Deutschen Zentrums für Luft- und Raumfahrt Prof. Dr.-Ing. Johann – Dietrich Wörner). Die Struktur des FFR. Der paritätisch besetzte Koordinierungsrat ist für die inhaltliche Arbeit des Forums verant-

wortlich, hier wird die Zielrichtung festgelegt. Inhaltlich wird in erster Linie im Expertengremium Aktiver Schallschutz (Erarbeitung, Überprüfung und Weiterentwicklung von Maßnahmen des Aktiven Schallschutzes) sowie im Umwelt- und Nachbarschaftshaus(UNH) (Fluglärmmonitoring, Gesundheitsstudie NORAH, Umweltmonitoring) gearbeitet. Das UNH ist betreibt darüber hinaus ein Informationszentrum, das neben der Information der Bürger auch den Dialog sucht und führt. Im Konvent des FFR wird der Dialog zwischen Kommunen, Betroffenen und der Luftverkehrsseite regelmäßig geführt.

Struktur des FFR

2.2 Mitveranstalter

Die ICANA 2013 wurde unterstützt von folgenden Institutionen/Firmen:

Arbeitskreis der Fluglärmkommissionen: http://www.flk-frankfurt.de
Fraport AG: http://www.fraport.de
Deutsche Lufthansa: http://www.lufthansagroup.com
Regionalverband Frankfurt RheinMain: http://www.region-frankfurt.de
DFS Deutsche Flugsicherung: http://www.dfs.de

3 Programm der ICANA 2013

2. Internationale Konferenz
Aktiver Schallschutz

30. – 31. Oktober 2013
Hilton Hotel Frankfurt Airport
THE SQUAIRE am Flughafen

forum flughafen & region
umwelt- und nachbarschaftshaus

Mit freundlicher Unterstützung durch:

Lufthansa
DFS Deutsche Flugsicherung
Fraport
Regionalverband FrankfurtRheinMain
ADF

Einführung

Nach der erfolgreichen Konferenz 2010 freuen wir uns, Ihnen die 2. Internationale Konferenz aktiver Schallschutz ankündigen zu können.

Die Konferenz soll dazu dienen, die für den Flughafen Frankfurt vorgesehenen Maßnahmen des aktiven Schallschutzes bekannt zu machen, internationalen Erfahrungsaustausch mit anderen Flughäfen, Flugsicherungsorganisationen und Luftfahrtgesellschaften zu organisieren und den aktuellen Stand dieses Themas für Frankfurt nutzbar zu machen.

Aktiver Schallschutz durch neue Flugverfahren, z. B.

Maßnahmen in Frankfurt seit 2010
Status, Umsetzung, Monitoringergebnisse:

- Umsetzungsfragen zu Segmented (RNAV) GPS Approach,
- erhöhter Gleitwinkel 3,2°, Startverfahren,
- gezielte Bahnnutzung und CDO;
- Wie berücksichtigt die EU regionale und lokale Lärmschutzbelange in ihrer Verkehrspolitik für die Luftfahrt in Europa?
- Welche Anreize und Incentives befördern aktiven Schallschutz?
- Was ist in der Entwicklung, was sagen die Anwender – von Flugsicherung bis Piloten?

Aktiver Schallschutz bei Luftfahrzeugen

Neue Entwicklungen bei Flugzeugen und Triebwerken:

- Was bieten Hersteller, was erwarten Luftfahrtgesellschaften?
- Welche Anreize benötigen Airlines, um in leise Technik zu investieren?
- Welche Anreize benötigen Hersteller, um leise Technik zur Marktreife zu entwickeln?

Mittwoch 30.10.2013
Programm

10:00 Uhr Registrierung

11:00 Uhr Begrüßung durch den Staatsminister sowie den Vorstand des Forums Flughafen und Region
M. Boddenberg, Hessischer Minister für Bundesangelegenheiten und Bevollmächtigter des Landes beim Bund
Prof. Dr.-Ing. J. D. Wörner,
Vorstand Forum Flughafen und Region (FFR)

11:30 Uhr Aktiver Schallschutz im Forum Flughafen und Region
M. Ockel, Bürgermeister Kelsterbach
A. Biestmann, Leiter Operations & Strategy, Deutsche Flugsicherung GmbH (DFS)

12:00 Uhr Forschung zum leiseren Fliegen – eine Tour d'Horizon über Möglichkeiten und Grenzen
Prof. Dr.-Ing. J. D. Wörner,
Vorstandsvorsitzender, Deutsches Zentrum für Luft- und Raumfahrt e. V. (DLR)

12:30 Uhr Mittagessen

13:30 Uhr Entwicklung leiseren Flugbetriebes durch neue Technologien und Flugverfahren
A. Dumoulin, Teamleiterin Operational Noise, Acoustics & Environment Department - EPA, AIRBUS Operations S.A.S.

14:00 Uhr Boeing – Forschung und Entwicklung von leiserem und leistungsfähigem Fluggerät
B. N. Shivashankara Ph. D., Senior Technical Fellow, Boeing Commercial Airplane Co.

14:30 Uhr Aktiver Schallschutz im Triebwerksbau
F. Holste, Chief of Acoustics,
Rolls-Royce Deutschland Ltd. & Co. KG

15:00 Uhr Lärmreduktion durch neue Triebwerkskonzepte
B. Köppel, MTU Aero Engines AG

Mittwoch 30.10.2013
Programm

15:30 Uhr Kaffeepause

16:00 Uhr Bedeutung des Aktiven Schallschutzes als Auswahlkriterium der Kaufentscheidung für die Lufthansa-Gruppe
N. Buchholz, Leiter Konzernflottenmanagement, Deutsche Lufthansa AG (DLH)

16:30 Uhr Wie wählt BA Flugzeuge in einem sensitiven HUB wie London-Heathrow aus
Captain D. Plumb, Strategy and Environment Manager, British Airways (BA)

17:00 Uhr Stand der Forschung zur Bekämpfung des Fluglärms an der Quelle
Prof. Dr.-Ing. J. Delfs,
Abteilungsleiter Technische Akustik, Deutsches Zentrum für Luft- und Raumfahrt e. V. (DLR) / Institut für Aerodynamik und Strömungstechnik

17:30 Uhr Conclusions 1. Tag
Prof. Dr.-Ing. J. D. Wörner, Vorstand FFR

20:00 Uhr Abendessen

Donnerstag 31.10.2013
Programm

08:30 Uhr Registrierung

09:00 Uhr Erfahrungen mit dem erhöhten Anflugwinkel von 3,2 Grad
Dr. R. König, Deutsches Zentrum für Luft- und Raumfahrt e. V. (DLR)

09:30 Uhr GBAS Entwicklung – weltweites Update
P. Reines, Business Development, Honeywell International Inc.

10:00 Uhr Aktionsplan Aktiver Schallschutz am Flughafen Arlanda in Stockholm
A. Näs, Stockholm Arlanda Airport

10:30 Uhr Kaffeepause

11:00 Uhr Steeper Approach – Forschungsprojekt des DLR und FFR
Dr. B. Korn, Deutsches Zentrum für Luft- und Raumfahrt e. V. (DLR)

11:30 Uhr Zukunftsperspektiven / Anforderungen an Luftverkehrskontrolle im Hinblick auf Lärmreduktion
I. Jopson, NATS London

Donnerstag 31.10.2013
Programm

12:00 Uhr EU Kommission, Aktiver Schallschutz in der EU-Politik
F. Cornelis, Referatsleiter Flugverkehrssicherheit - GD MOVE, EU-Kommission

12:30 Uhr Diskussionsrunde unter Einbeziehung des Plenums
„Viel Lärm um nichts? – Sind Chancen und Belastungen des Flugverkehrs ausgewogen? Möglichkeiten, Erwartungen und Realitäten – Über die Chancen und Belastungen des Luftverkehrs“
Moderation: Thomas Ranft
Prof. Dr.-Ing. J. D. Wörner,
Vorstandsvorsitzender, Deutsches Zentrum für Luft- und Raumfahrt e. V. (DLR)
F. Cornelis, Referatsleiter Flugverkehrssicherheit - GD MOVE, EU-Kommission
P. Schmitz, Vorstandsmitglied Fraport AG
S. Alegre Calero, Präsident der Airport Regions Conference (ARC)
I. Jopson, NATS London

13:30 Uhr Zusammenfassung / Conclusions
Prof. Dr.-Ing. J. D. Wörner, Vorstand FFR

14:00 Uhr Mittagessen

15:00 Uhr Ende der Veranstaltung

Organisatorische Hinweise:

Teilnahmebeitrag: 100,00 €
Es wird eine Tagungspauschale in Höhe von 100,00 € erhoben.

Die verbindliche Teilnahmeregistrierung erfolgt erst nach Eingang des Teilnahmebeitrages.

Anmeldung
Anmeldungen und Bezahlung bitte über die Webseite:
http://tinyurl.com/q6mhw6j

Tagungsort
Hilton Hotel Frankfurt Airport
THE SQUAIRE – Am Flughafen
60549 Frankfurt a. M.

Für die Teilnehmer ist ein Zimmerkontingent zum Vorzugspreis von 189,00 € reserviert. Zimmerreservierungen im Hotel unter Angabe des Stichwortes „ICANA 2013“ oder direkt über die Website: http://tinyurl.com/ohds5kl

Nachfragen
zu allen organisatorischen Details per Email an
info@umwelthaus.org
oder telefonisch bei Frau Alice Wilczek
unter +49 (0) 6107 98868-13

Für Fragen steht Ihnen während der Konferenz gerne das Team des Umwelt- und Nachbarschaftshauses zur Verfügung.

Impressum

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2nd International Conference on
Active Noise Abatement

October 30th – 31th, 2013
Hilton Hotel Frankfurt Airport
THE SQUAIRE at the airport

forum flughafen & region umwelt- und nachbarschaftshaus

With the kind support of:

Lufthansa

DFS Deutsche Flugsicherung

Fraport

Regionalverband FrankfurtRheinMain

ADF

Introduction

After the successful conference in 2010 we are delighted to announce the 2nd International Conference on Active Noise Abatement.

The conference is aimed at publicising the active noise abatement measures planned for Frankfurt Airport, organising an international exchange of experience with other airports, air traffic control organisations and airline companies, and at applying the current state of the art in this area to Frankfurt.

Active noise abatement due to new flight procedures, e. g.

Measures in Frankfurt since 2010
status, implementation, monitoring results:

- implementation issues regarding the Segmented (RNAV) GPS Approach,
- increased approach angle 3.2°, take-off procedures,selective runway use and CDO;
- How does the EU take into consideration regional and local noise abatement concerns in its transport policies for aviation in Europe?
- Which benefits and incentives promote active noise abatement?
- What is being developed, what are the users saying – from air traffic control to the pilots?

Active noise abatement for aircraft

New developments in planes and engines:

- What have the manufacturers to offer, what do the airline companies expect?
- What incentives do airlines need to invest in quiet technology?
- What incentives do manufacturers need to develop quiet technologies to market maturity?

Wednesday, Oct. 30th, 2013
Agenda

10.00 a.m.	Registration
11.00 a.m.	Welcome address by the Hessian Minister of Federal Affairs and the Director of Airport and Region Forum *M. Boddenberg*, Hessian Minister of Federal Affairs and the state's mandatory for the Federation *Prof. Dr.-Ing. J. D. Wörner*, Director of Airport and Region Forum
11.30 a.m.	Active Noise Abatement in Airport and Region Forum *M. Ockel*, Mayor of Kelsterbach *A. Biestmann*, Head of Operations & Strategy, German Air Traffic Control (Deutsche Flugsicherung GmbH – DFS)
12.00 p.m.	Research on less noisy aviation – a tour d'horizon about possibilities and limits *Prof. Dr.-Ing. J. D. Wörner*, CEO of German Aerospace Center (Deutsches Zentrum für Luft- und Raumfahrt e. V. – DLR)
12.30 p.m.	Lunch
01.30 p.m.	Developing quieter aircraft operations through technologies and flight management *A. Dumoulin*, Operational Noise Team Leader, Acoustics & Environment Department – EPA, AIRBUS Operations S.A.S.
02.00 p.m.	Boeing research and development for quieter and efficient aircraft *B. N. Shivashankara Ph. D.*, Senior Technical Fellow, Boeing Commercial Airplane Co.
02.30 p.m.	Active Noise Abatement in engine construction *F. Holste*, Chief of Acoustics, Rolls-Royce Deutschland Ltd. & Co. KG
03.00 p.m.	Noise reduction by new engine concepts *B. Köppel*, MTU Aero Engines AG

Wednesday, Oct. 30th, 2013
Agenda

03.30 p.m. Coffee break

04.00 p.m. Importance of Active Noise Abatement as a selection criterion in purchasing for the Lufthansa-Group
N. Buchholz, Head of the procurement of aircraft, Deutsche Lufthansa AG (DLH)

04.30 p.m. How does BA select aircraft in a sensitive hub like London-Heathrow
Captain D. Plumb, Strategy and Environment Manager, British Airways (BA)

05.00 p.m. Latest research on the reduction of aircraft noise at source
Prof. Dr.-Ing. J. Delfs, Head of Technical Acoustics, German Aerospace Center (Deutsches Zentrum für Luft- und Raumfahrt e. V. – DLR) / Institute of Aerodynamics and Flow Technology

05.30 p.m. Day 1 conclusions
Prof. Dr.-Ing. J. D. Wörner, Director of Airport and Region Forum

08.00 p.m. Dinner

Thursday, Oct. 31st, 2013
Agenda

08.30 a.m. Registration

09.00 a.m. Experience with the steeper approach angle of 3.2 degrees
Dr. R. König, German Aerospace Center (Deutsches Zentrum für Luft- und Raumfahrt e. V. – DLR)

09.30 a.m. GBAS development – update worldwide
P. Reines, Buisness Development, Honeywell International Inc.

10:00 a.m. Action plan for active noise abatement at Stockholm Arlanda Airport
A. Näs, Stockholm Arlanda Airport

10.30 a.m. Coffee break

11.00 a.m. Steeper Approach – a research project of DLR and Airport and Region Forum
Dr. B. Korn, German Aerospace Center (Deutsches Zentrum für Luft- und Raumfahrt e. V. - DLR)

11.30 a.m. Future perspectives / requirements for air traffic control in order to reduce noise
I. Jopson, NATS London

Thursday, Oct. 31st, 2013
Agenda

12.00 p.m. EU Commission, EU policy on Active Noise Abatement
F. Cornelis, Head of Unit Aviation and Safety – DG MOVE, EU-Commission

12.30 p.m. Plenary discussion panel
”Lot of fuss about nothing? – Are opportunities and pressures of air traffic balanced? Opportunities, expectations and reality – About opportunities and pressures of air transport“
Moderation: Thomas Ranft
Prof. Dr.-Ing. J. D. Wörner, CEO of German Aerospace Center (DLR)
F. Cornelis, Head of Unit Aviation and Safety – DG MOVE, EU-Commission
P. Schmitz, Board of Directors Fraport
S. Alegre Calero, President of airport regions conference (ARC)
I. Jopson, NATS London

01.30 p.m. Summary / Conclusions
Prof. Dr.-Ing. J. D. Wörner, Director of Airport and Region Forum

02.00 p.m. Snack

03.00 p.m. End of the event

Organisational information:

Participation fee of Euro 100
A one-off conference fee of Euro 100 shall be charged.

Registration of participation shall only be confirmed after receipt of the participation fee.

Application
Application and payment through the website:
http://tinyurl.com/nw57dvz

Venue
Hilton Hotel Frankfurt Airport
THE SQUAIRE – Am Flughafen
60549 Frankfurt a. M.

A contingent of rooms has been reserved to the special price of Euro 189 for participants. Please state the reference “ICANA 2013” for room reservations in the Hilton Hotel. More detailed information will be published shortly on this website: http://tinyurl.com/ohds5kl

Enquiries
on any organisational details
by e-mail to: info@umwelthaus.org
Telephone enquiries:
Mrs. Alice Wilczek +49 (0) 6107 98868-13

Please speak to a member of the Environment and Community Center team if you have any questions during the conference.

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Präsentationen

4 Präsentationen

4.1 Begrüßung Staatsminister Boddenberg

Link zum Mitschnitt:
Deutsch: http://www.youtube.com/watch?v=LmF1q5qRvY0&feature=youtu.be
English: http://www.youtube.com/watch?v=Pk7Qg_DQtuk&feature=youtu.be

4.2 Aktiver Schallschutz im Forum Flughafen und Region

4.2.1 Vortragende

Manfred Ockel, Bürgermeister der Stadt Kelsterbach

Manfred Ockel, Jahrgang 1959, ist seit 2008 Bürgermeister der Stadt Kelsterbach.
Zuvor führte er schon für die gleiche Stadt das Amt des Ersten Stadtrats aus.
Begonnen hatte Ockel sein Berufsleben bei der Stadt Rüsselsheim.
Nach seinem Studium der Geografie an der Johannes-Gutenberg-Universität in Mainz, das er mit einem Diplom anschloss., begann er 1985 als Sachbearbeiter in dem damals neugeschaffenen Arbeitsfeld Umwelt- und Naturschutz.
1998 wurde er zum Amts- und Fachbereichsleiter „Umwelt und Grün“ der Stadt Rüsselsheim berufen.
Seit 2008 ist Ockel gleichzeitig Co-Vorsitzender des Expertengremiums Aktiver Schallschutz.

André Biestmann, DFS Deutsche Flugsicherung GmbH

Andre Biestmann leitet den Bereich „Airspace and Air Navigation Service Support“ der DFS und ist hierbei zuständig für die Erstellung von Flugverfahren für den gesamten deutschen Luftraum sowie die Entwicklung von Verfahren für die Tower- und Strecken-Lotsen der DFS. Die Flugverfahren (inkl. der Verfahren für den Aktiven Schallschutz) für den größten Hub-Airport in Kontinental-Europa FRA stellen einen besonderen Schwerpunkt dar. Andre Biestmann ist Vorsitzender der Expertengruppe Aktiver Schallschutz (ExpASS) im Forum Flughafen und Region FRA (FFR).
Nach seiner Ausbildung zum Fluglotsen (1990) an der Flugsicherungsakademie in Langen war er lange Jahre in der Kontrollzentrale Bremen als Strecken-Fluglotse sowie Projektleiter für verschiedene Sonderaufgaben tätig.
Seine Führungskarriere bei der DFS startete als Wachleiter sowie Leiter des operativen Büros in der Kontrollzentrale Bremen. Im Jahr 2007 kam der Wechsel nach Langen in die Unternehmenszentrale.

Andre Biestmann ist in verschiedenen internationalen Gremien tätig [u. a. bei der ICAO (International Civil Aviation Organization) in Montréal

4.2.2 Präsentation

Link zum Mitschnitt der Präsentation:

Deutsch: http://www.youtube.com/watch?v=teQhkObvhns&feature=youtu.be
http://www.youtube.com/watch?v=XlRjMCfP2FI&feature=youtu.be

English: http://www.youtube.com/watch?v=Lv8yTlBDNUk&feature=youtu.be
http://www.youtube.com/watch?v=a6Q620pNJ9M&feature=youtu.be

ICANA 2013

Active Noise Abatement in Airport and Region Forum

M. Ockel, Mayor of Kelsterbach
A. Biestmann, Director Airspace & ANS Support
Deutsche Flugsicherung GmbH (DFS)

Manfred Ockel

Introduction

Expert Group on Active Noise Abatement – Procedure

- Identifying measures for active noise abatement and verifying them for suitability, applicability and ICAO conformity
- Representatives of airport, airline, ATC, pilots, research institutes, towns and cities, authorities
- Subgroups: operative, perspective, noise, incentive, roll and ground noise

Basic conditions:

- Safety and capacity requirements are met
- Noise reduction is achievable
- Technical and operational feasibility at Frankfurt airport
- No legal approval in advance

Expert Group on Active Noise Abatement – Results

- First package of measures presented in June 2010 containing recommendations for e. g. preferred runway usage (DROps), vertical optimisation of departure procedures, segmented RNAV approach, optimisation of CDA, modification of aircraft engines (B 737)
- Trial operations end of 2010/ beginning 2011
- Monitoring of the measures 2011/ 2012
- Monitoring report in June 2012
- Bunch of measures (Trial operations) in October 2012
- Currently further development of measures and examination of new suggestions – second package of measures is expected in 2014

An idea comes to life
Workflow for new measures of active noise abatement (I)

Idea for a new measure: from Expert Group on Active Noise Abatement, from municipal parties, from Aircraft Noise Commission (FLK)

- Taken over by one of the subgroups of the Expert Group on Active Noise Abatement (usually subgroup „Operative“)

- **Progressive assessment:**
- Measure part of index?
- Procedure/ structure compliant with ICAO?
- Feasibility for flying?
- Noise-balance?
- Capacity day/ night?
- additionally: possible relief for those burdened by the first package of measures?

- short-term (launch/ realisation within 12 months)
- medium-term (launch/ realisation within 2 to 4 years)
- long-term (launch/ realisation earliest in 5 years)

An idea comes to life

Workflow for new measures of active noise abatement (II)

Steps of the test programme

Calculation of expected noise level of new measure

- Subgroup noise: Calculations take place in order to estimate the expected noise levels
- Calculation and estimation where people will experience positive or negative effects of the measure
- Further discussion based upon the results above to decide on execution of test runs

→ Decision whether test runs should be executed

Execution of test runs

- Test runs have to be approved, usually scheduled and executed by the DFS
- Test runs usually last one year

Monitoring and assessment of test runs

- Subgroup noise: Continuous noise monitoring during the 1 year period of the test runs
- New noise calculations on the basis of the data collected during the test runs
- New assessment of the impact of the measure

→ Decision whether measure should be implemented

Permanent implementation of new measure

Andre Biestmann

What is currently happening? Practical Examples

Subgroup operative
Example No. 1 –: Optimization of flight path “KNG/AMTIX kurz”

Background:

- The departure route "KNG/AMTIX kurz“: southeast-bound departures from the western runway (runway 18)
- Departure route „KNG/AMTIX kurz“ goes across densely populated areas of Darmstadt north.
- It is currently being checked whether a lateral shift can be implemented.
- Designs of 5 alternative flight paths from Runway 18 were developed (Route description of the DFS, but excluding corridor width and alternates routes);
- First noise calculations were made.

“KNG/AMTIX kurz”: Simulation: Lateral Performance (by avia consult)

Comparison: simulated flight paths with nominal flight paths

- Applies with the following parameters
- ARINC coding
- Flight path description and encoding

  between waypoints
- Aircraft Type
- Kinematic limitations
- Weather simulations
- GPS satellite signal quality
- Simulation 40 Samples
- Fly-Over vs. Fly-By?

Optimizing of flight path “KNG/AMTIX kurz” – to be done….

- Integration with noise data of Egelsbach airport;
- Creation of delta maps in dB (A) day for status quo versus the best variants.

Subgroup incentive
Example No. 2: Airline Benchmarking

Intention: Creation of transparency …

… in how far do airlines differ in noise emission/ immission and flight procedures at Frankfurt Airport.

Through:

- Regular publication of airline-rankings based on a specific set of parameters.
- Possibility for airlines to be able to assess their own performance against the competitors.
- Long-term incentives of noise reduction.

Best performance for noise abatement

Airline Benchmarking – First steps, first sample analyzes

1. Noise certification vs. noise measurement
    - Noise certification - Problem: data provision
    - Noise measurement and evaluation based on data collected at hotspots:
        - Which airline is above or below the mid-type-level?
            - Evaluation is type-specific and
            - divided in short, middle and long distance flights

2. Compliance with the flight procedures
    - Application of active noise abatement measures
    - Lateral compliance of flight path

Subgroup roll and ground noise
Example No. 3: Thrust reversal – monitoring

Background:

- Result of planning permission: Use of thrust reversal during landing operations at Frankfurt airport is forbidden – except for safety cases and idle Power Reverse.
- Development of a procedure for monitoring – Fraport AG, DLR and expert group (measure campaign).

Thrust reversal – Two measurement campaign in Frankfurt

DLR: Focus of the analysis of the exhaust beam (IR-technology) and changes in the frequency composition (acoustic).

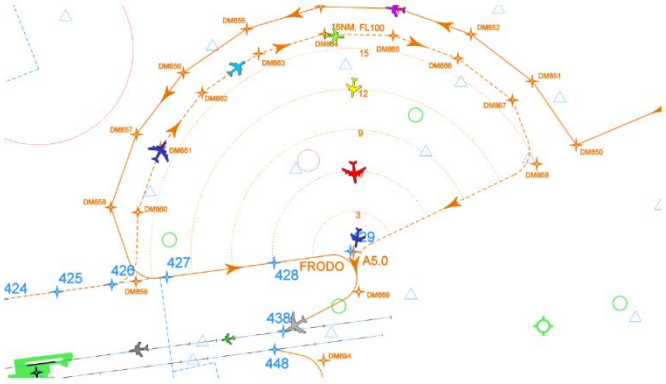
When setting thrust reverse with more than idle Power Reverse….

- Increases or change the exhaust - core jet (Working hypothesis IR) ?
- Change the noise level of individual frequencies (Working hypothesis Acoustic) ?

Subgroup perspective
Example No. 4: Point Merge

Background:

- Approach procedure, which is primarily used to simplify the handling of highly complex and traffic-rich approach flows
- Although the Point Merge System can lead to noise reduction
  - this will not affect the final approach area. Here, the aircraft still use the ILS guides.
  - a noise reduction can be achieved in the outer region, before the final approach.



Point Merge – first steps and perspective

- Fast and real-time simulations by DFS to review the capacitive and operational impact.
- First noise calculations by DFS
- Result: 3 alternatives are recessed for consideration

4.3 Forschung zum leiseren Fliegen – eine Tour d'Horizon über Möglichkeiten und Grenzen

4.3.1 Vortragender

Prof. Dr. Ing. Johann-Dietrich Wörner, Vorsitzender Deutsches Zentrum für Luft- und Raumfahrt

Johann-Dietrich Wörner was born in Kassel in 1954. He has been Chairman of the Executive Board of the German Aerospace Center (DLR) since 1 March 2007.

He studied civil engineering at the Technische Universität Berlin and the Technische Hochschule Darmstadt, from where he graduated in 1985. In 1982, as part of his studies, he spent two years in Japan, investigating earthquake safety. Until 1990 Wörner worked for the consulting civil engineers König und Heunisch. In 1990 he returned to Darmstadt University, where he was appointed to a professorship in Civil Engineering and took over as Head of the Testing and Research Institute. Before being elected President of the Technische Universität Darmstadt in 1995, he held the position of Dean of the Civil Engineering Faculty.

Wörner has been honoured with a series of prizes and awards such as the Prize of the Organisation of Friends of the Technische Universität Darmstadt for 'outstanding scientific performance'. He was also appointed to the Berlin Brandenburg Academy of Sciences and is a representative of the Technical Sciences Section of the German Academy of Sciences Leopoldina. Wörner has received honorary doctorates from the State University New York (USA), the technical universities of Bucharest (Romania) and Mongolia, the Saint Petersburg University for Economics and Finance (Russia), and École Centrale Lyon (France). He has been honoured by the German state of Hesse and the French government.

Wörner is Vice President of the Helmholtz Association; he is also a member of various national and international supervisory bodies, advisory councils and committees. He was a member of the board of École Centrale Paris and École Centrale Lyon, the Convention for Technical Sciences (acatech) and the supervisory board of Röhm GmbH, to name just a few. Furthermore, he was appointed to the energy expert group of the German Government. He continues to be a member of the advisory boards of several universities such as the Technische Universität Berlin and the IST Lisboa.

Further Information about the company:

DLR is the national aeronautics and space research centre of the Federal Republic of Germany. Its extensive research and development work in aeronautics, space, energy, transport and security is integrated into national and international cooperative ventures. In addition to its own research, as Germany's space agency, DLR has been given responsibility by the federal government for the planning and implementation of the German space programme. DLR is also the umbrella organisation for the nation's largest project execution organisation.

DLR has approximately 7400 employees at 16 locations in Germany: Cologne (headquarters), Augsburg, Berlin, Bonn, Braunschweig, Bremen, Goettingen, Hamburg, Juelich, Lampoldshausen, Neustrelitz,

Oberpfaffenhofen, Stade, Stuttgart, Trauen, and Weilheim. DLR also has offices in Brussels, Paris, Tokyo and Washington D.C.

4.3.2 Präsentation

Link zum Mitschnitt der Präsentation:

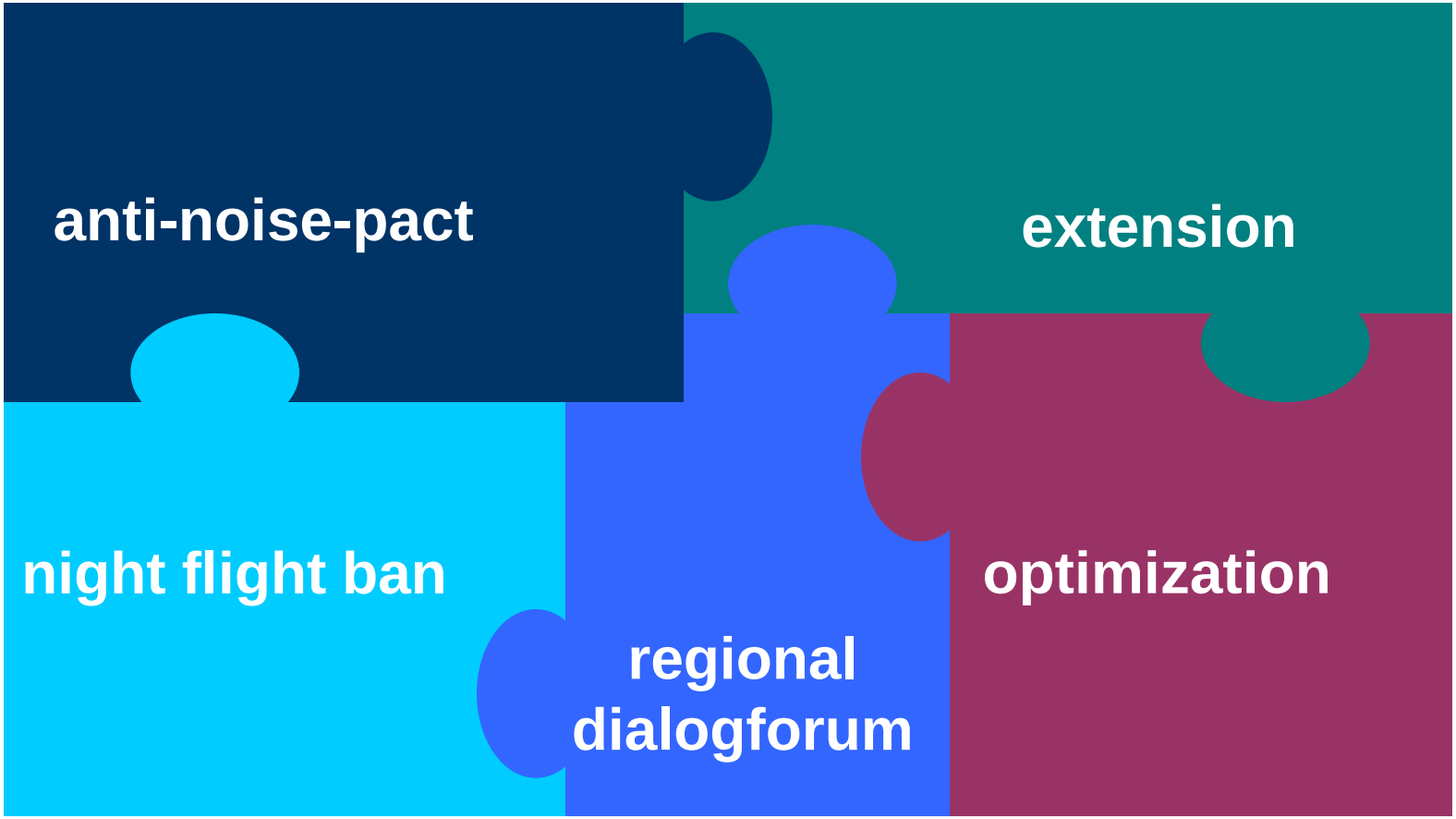
Deutsch: http://www.youtube.com/watch?v=OgjOUAVoQXE&feature=youtu.be

English : http://www.youtube.com/watch?v=5E8bQgwQBDQ&feature=youtu.be

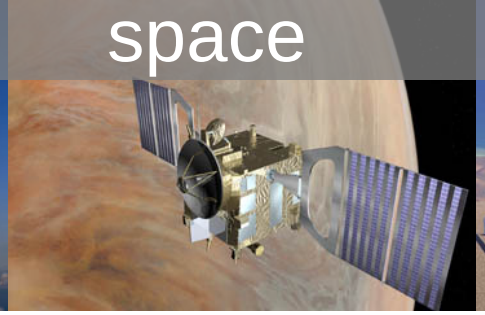
Research on less noisy aviation – a tour d´horizon about possibilities and limits

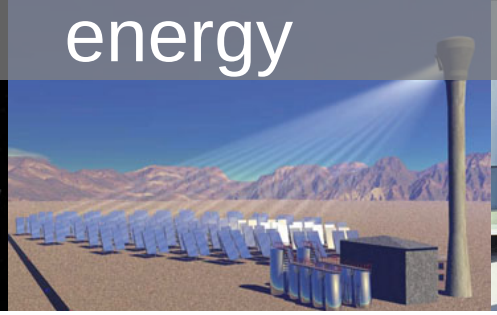
Jan Wörner
Deutsches Zentrum für Luft- und Raumfahrt - DLR
German Aerospace Center
Forum Flughafen und Region

Extension of Frankfurt Airport
→mediation package



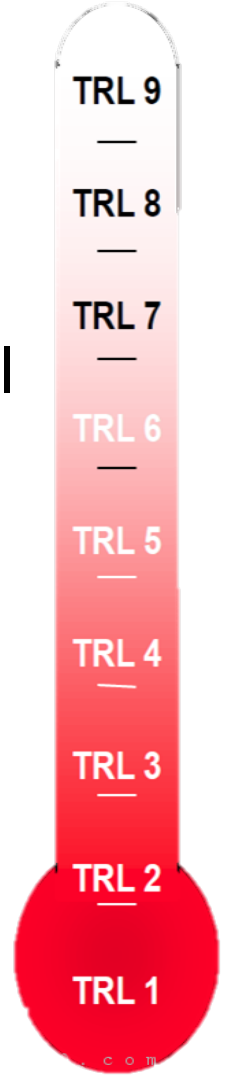
DLR





Research Center
&
German Space Agency
&
Project Management Agency for Aeronautical Research and Technology

Technology Readiness Level



DLR

Seamless Chain of Innovation

Invention → Innovation

Areas/ Disciplines

DLR

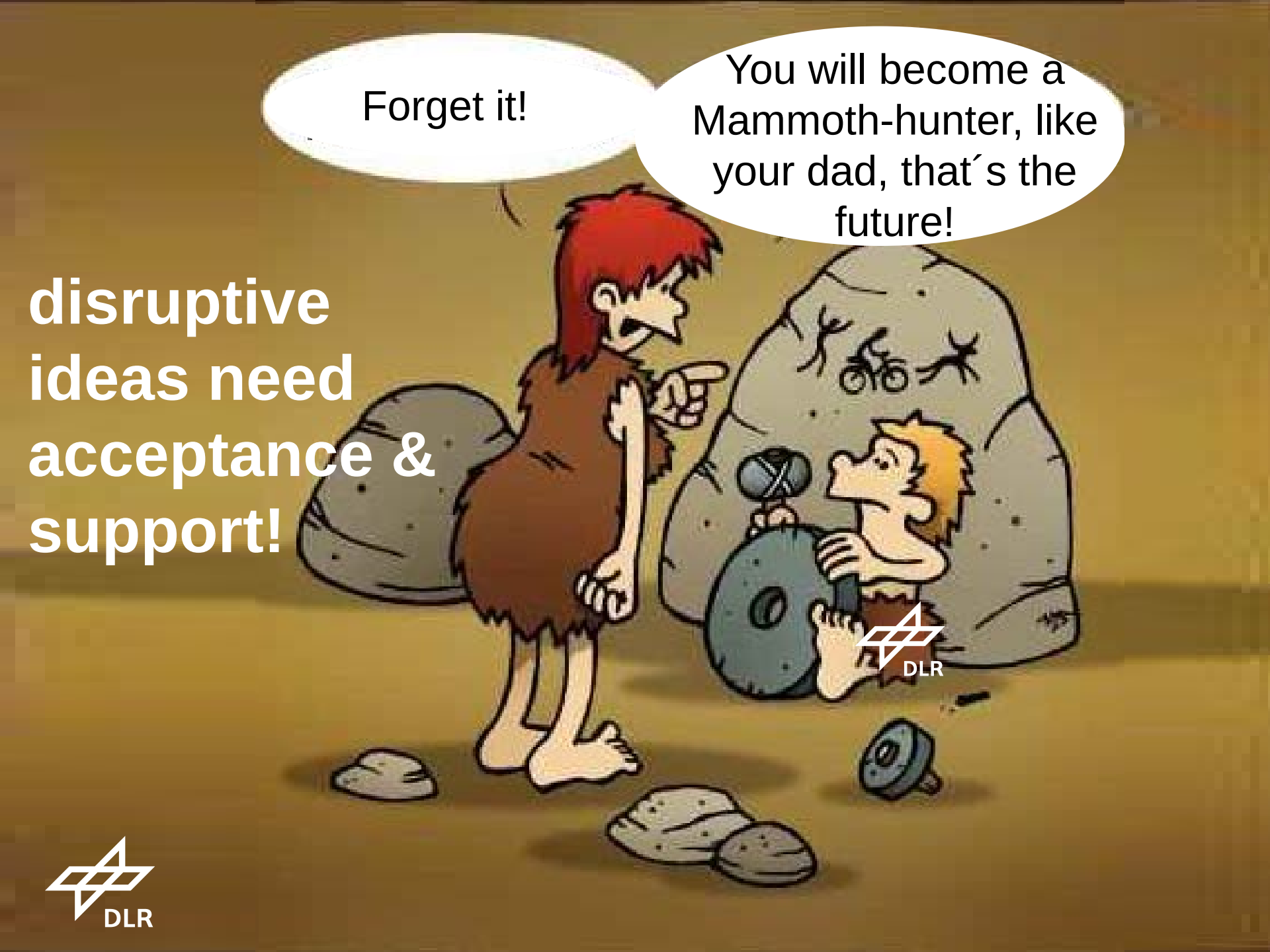
Industry
Society
End-user

basic research

applied research

development

market

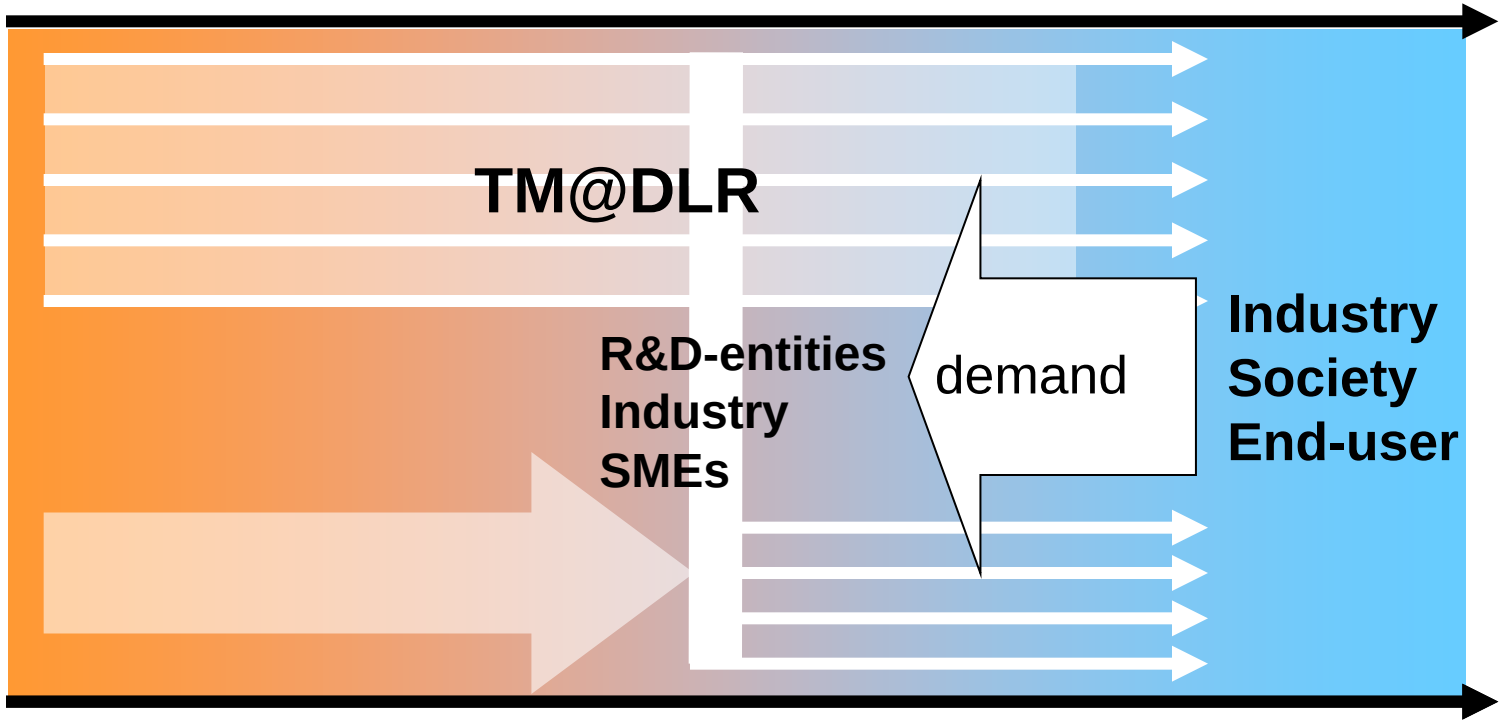

Forget it!
You will become a Mammoth-hunter, like your dad, that´s the future!
disruptive ideas need acceptance & support!
DLR
DLR

Seamless Chain of Innovation

Invention → Innovation

Aeronautics
Space
Energy
Transport
Security

…
…
Water
Agriculture
Entertainment
Medicine



Aeronautics:

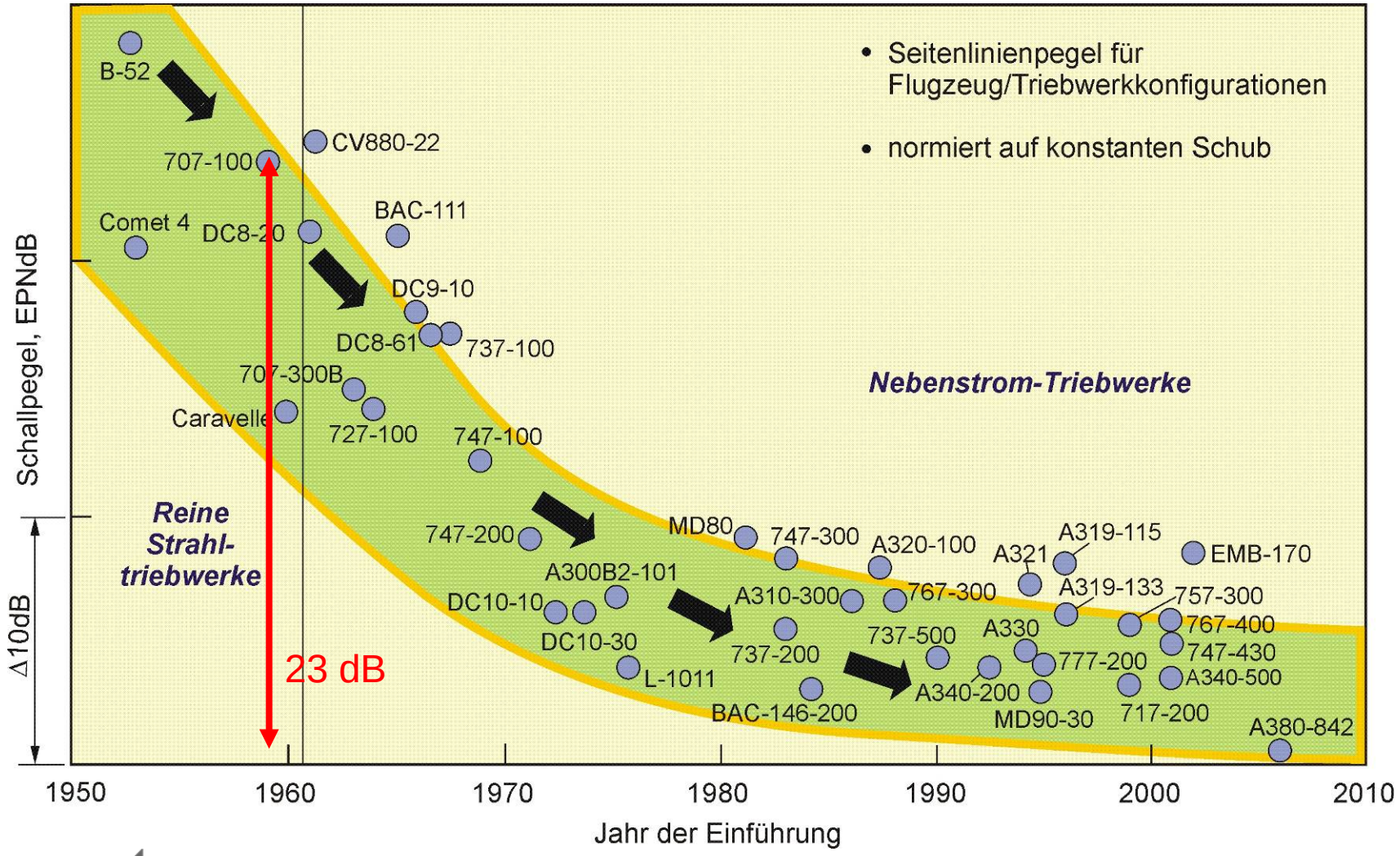
- safety/security
- ecology/climate
- economy

Sources of noise

DLR

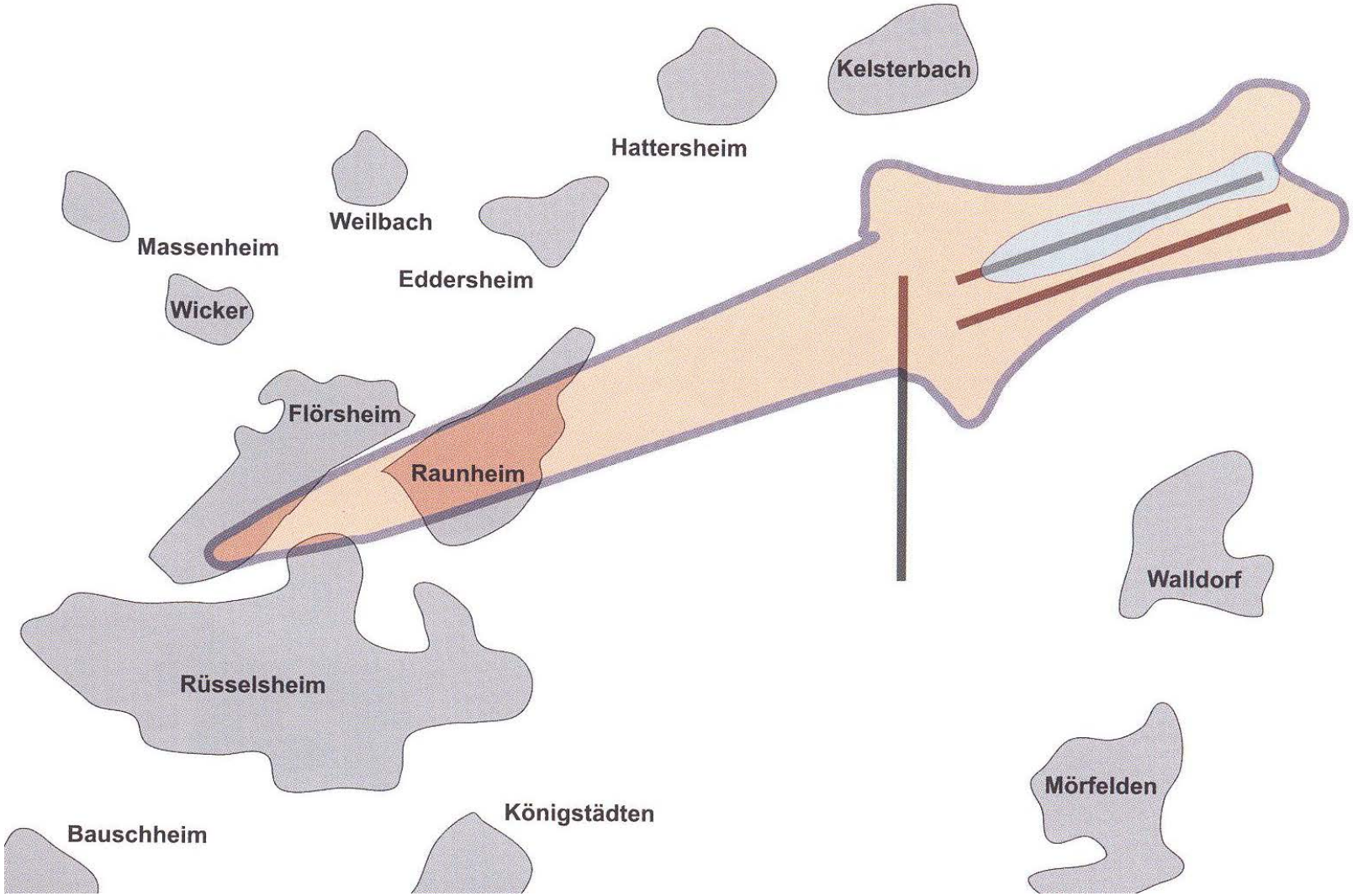
Bildquelle: Wikimedia Commons

Success of noise reduction



DLR

Comparison 85 dB Boeing 727 / Airbus A320

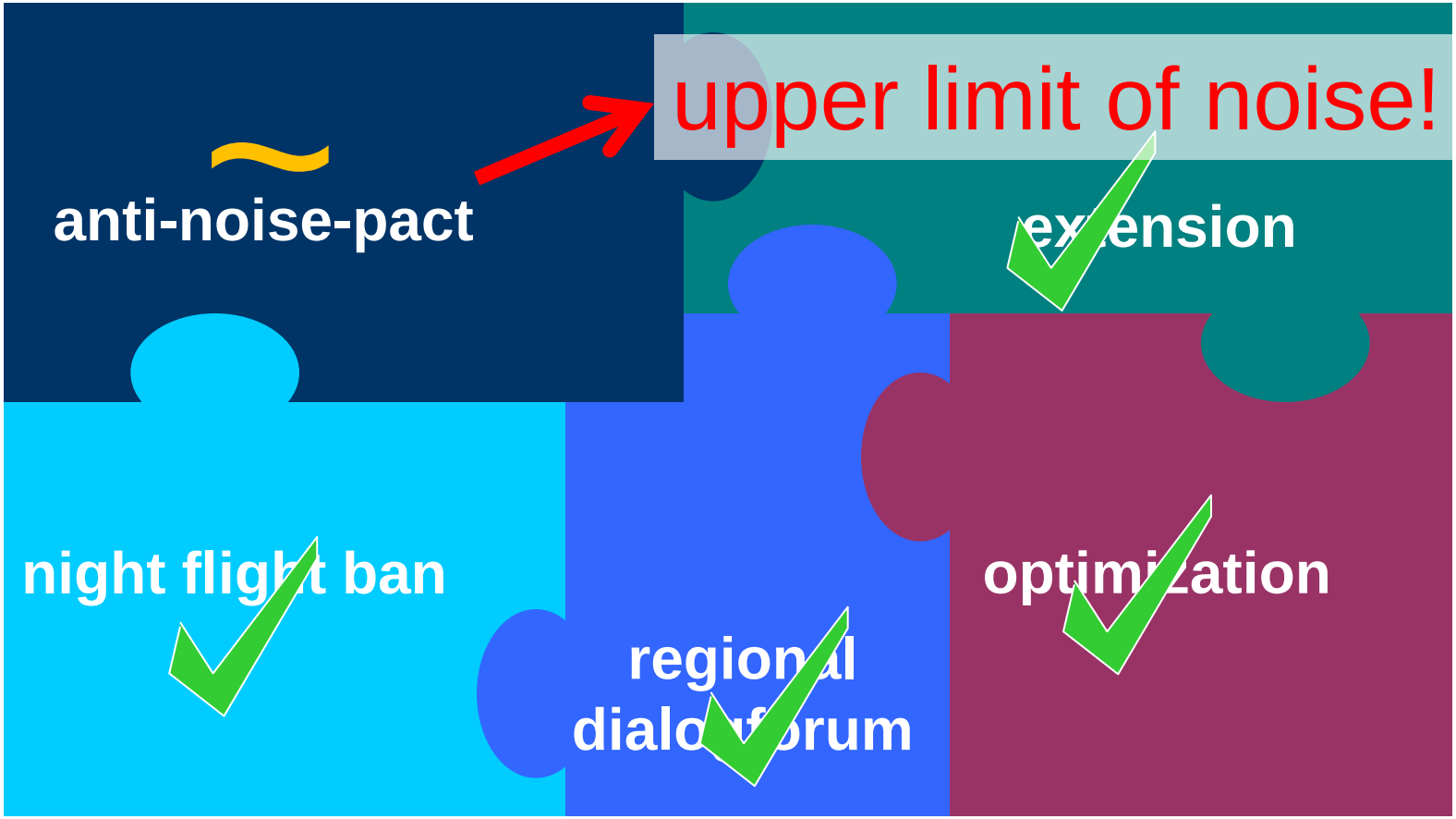


DLR


External conditions and impact:
airports, society, …
Aircraft as one system
sub systems:
engines, landing
gears, wing / slats /
flaps, …

DLR

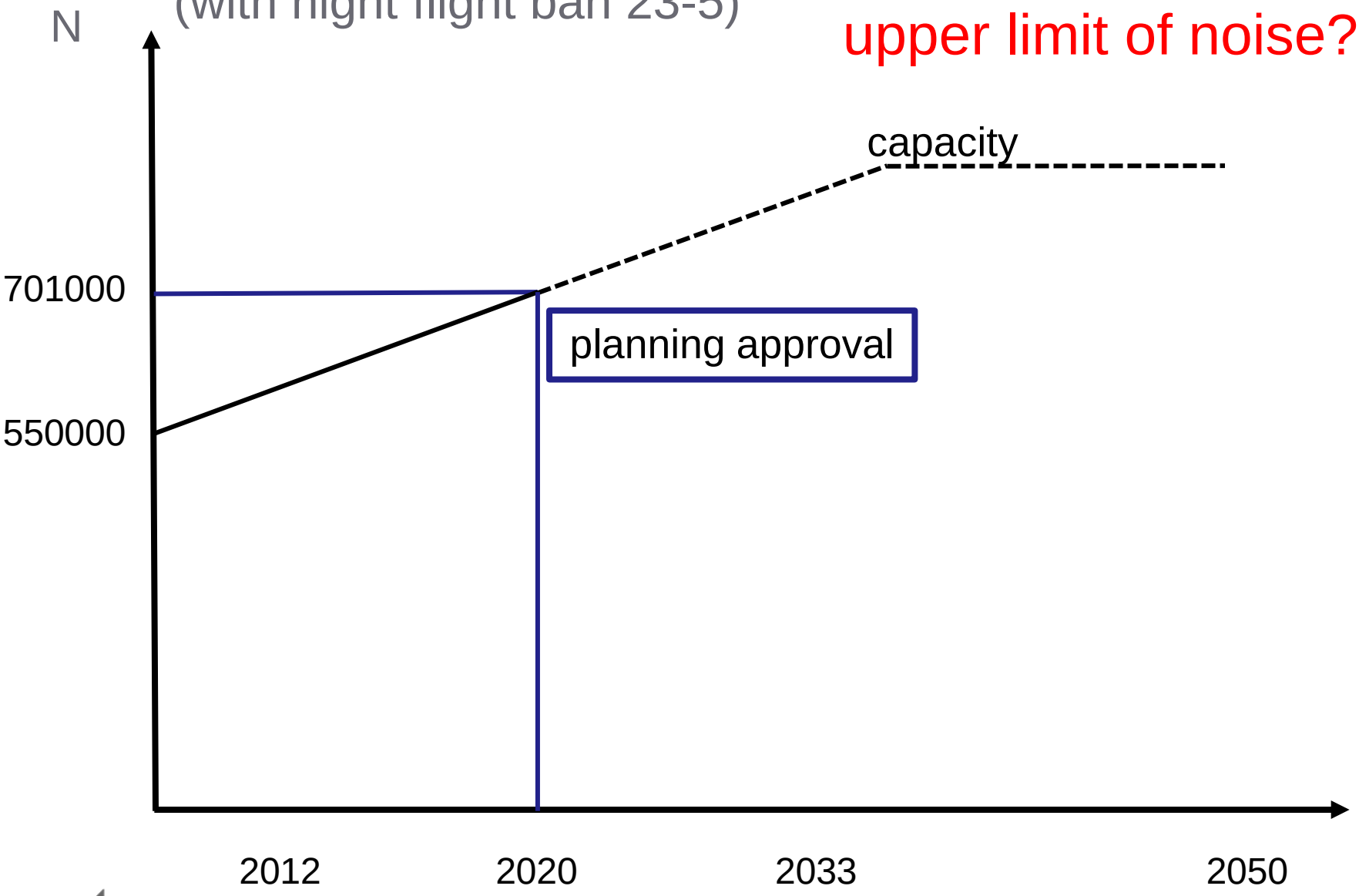
Extension of Frankfurt Airport
realisation of mediation package



DLR

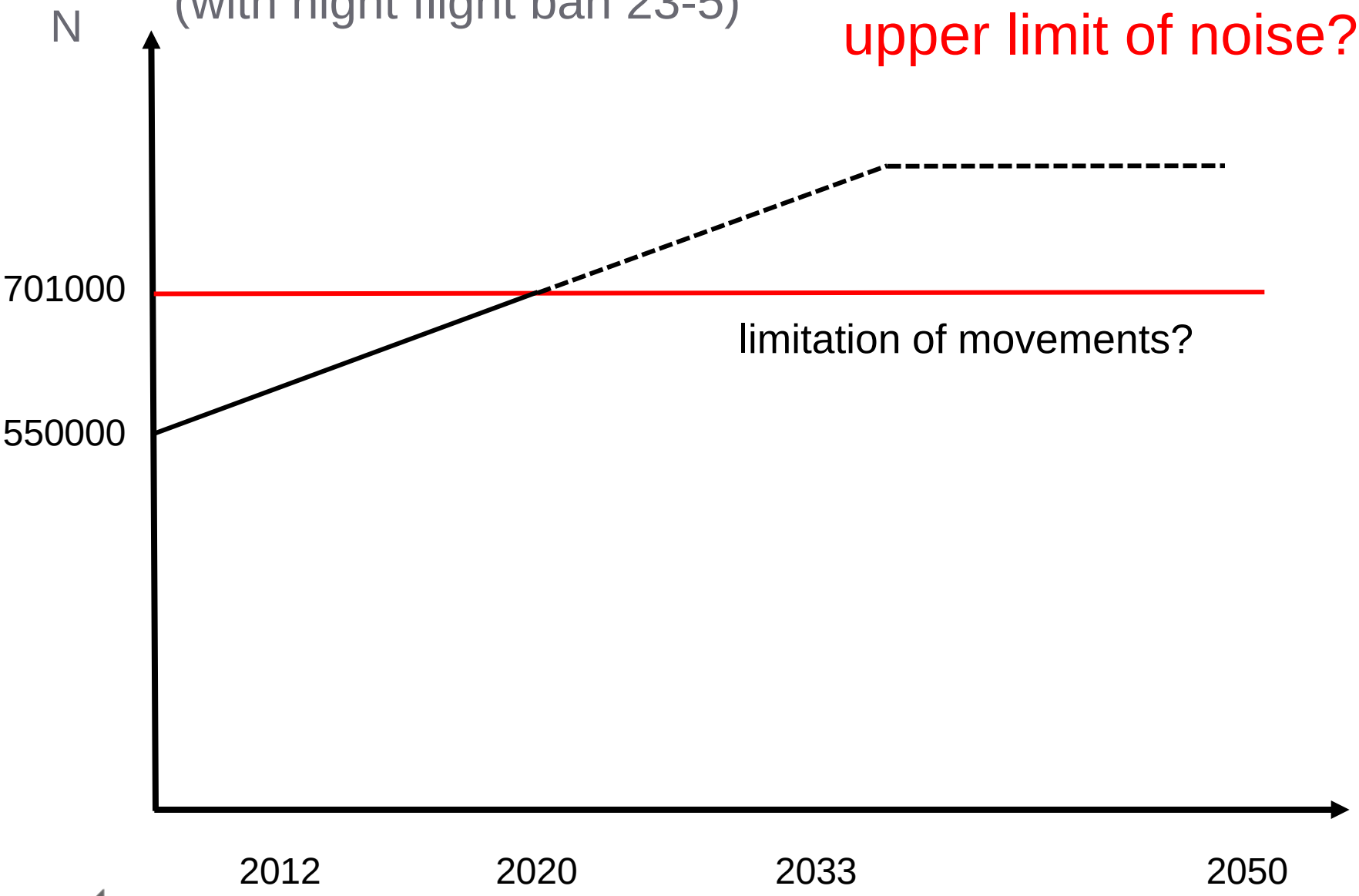
2013

Development of aircraft movements (with night flight ban 23-5)



2013

Development of aircraft movements (with night flight ban 23-5)



2013

Development of aircraft noise (with night flight ban 23-5)

upper limit of noise?

„noise“

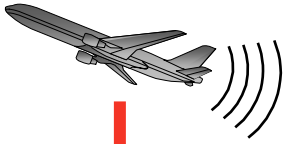
without active noise protection

noise?

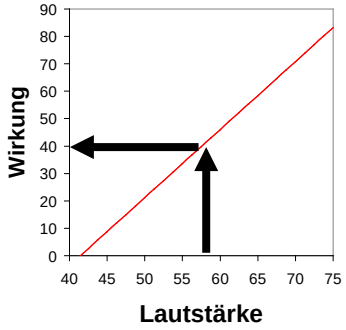
- dB at a certain location?
- areas with certain dBs?
- number of highly annoyed!

2012 2020 2050

noise index



population density



FTI:
number highly annoyed

noise index

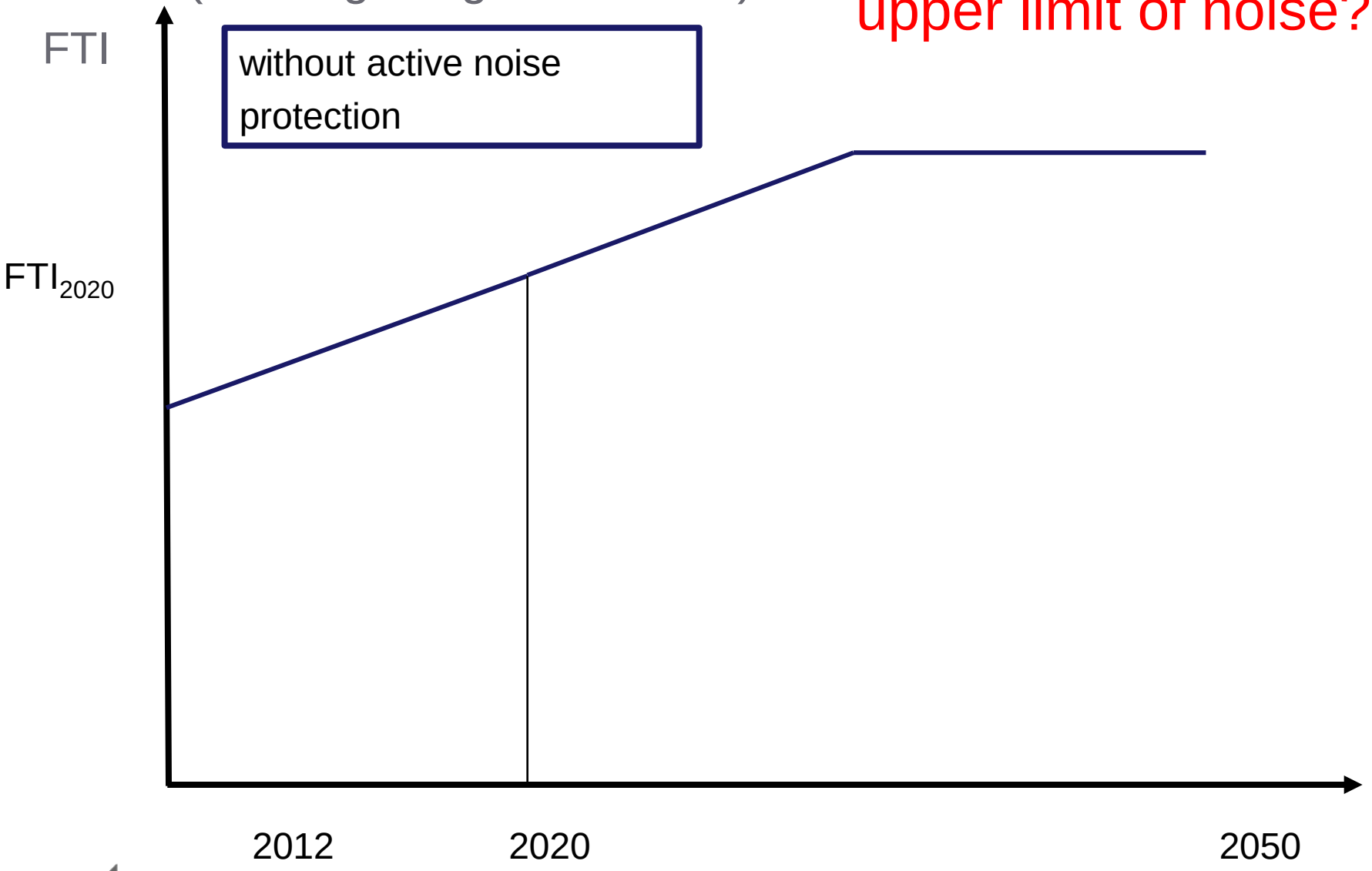
FNI
number additional EEG-wake ups

DLR

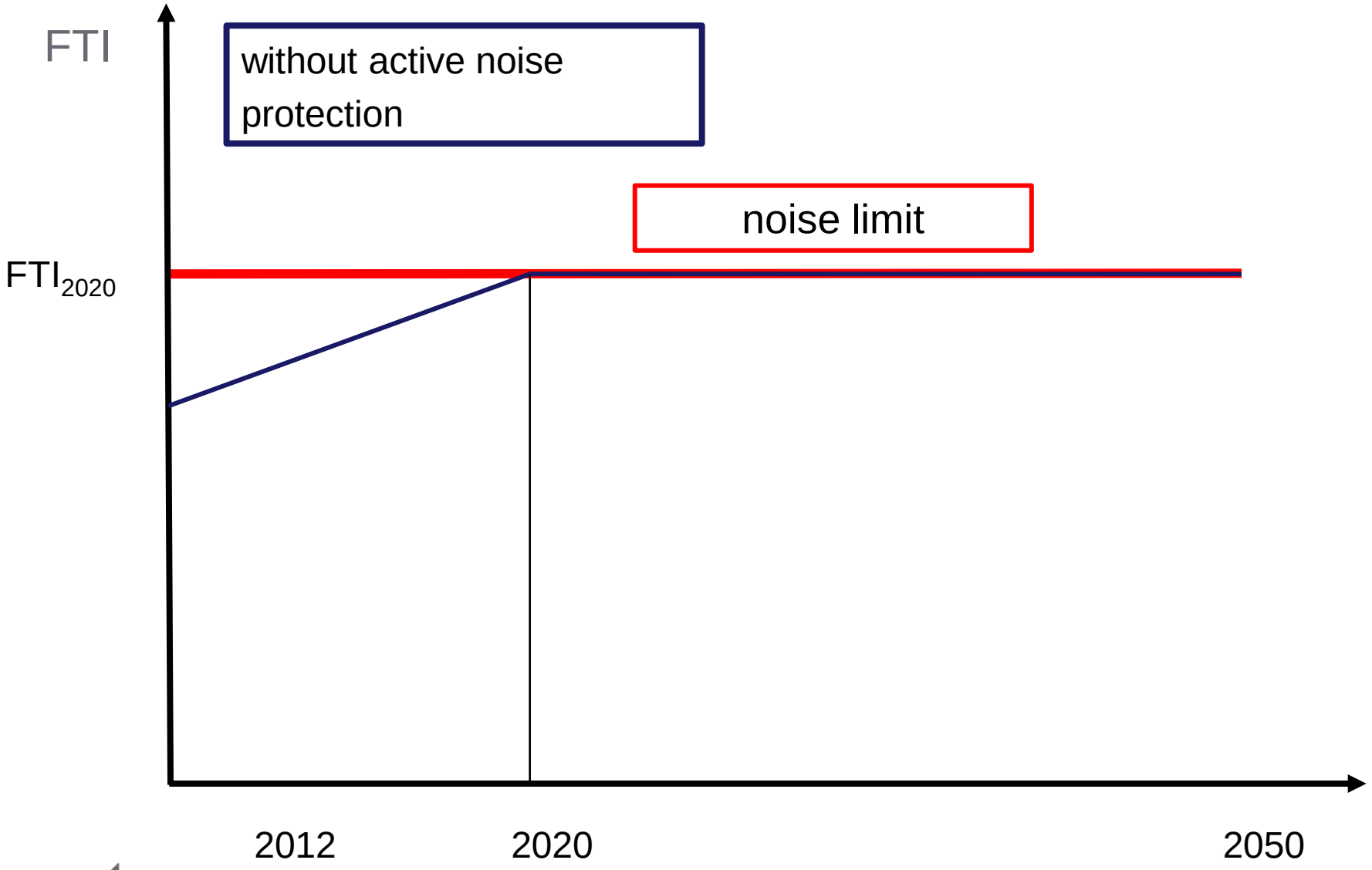
2013

Development of aircraft noise (with night flight ban 23-5)

upper limit of noise?



2013 development noise index



Bundesministerium
für Wirtschaft
und Technologie

National Aviation-Strategy

ACARE

Strategic Research and Innovation Agenda (SRIA)

Flightpath 2050
Europe's Vision
for Aviation

Report of the High Level Group
on Aviation Research

DLR

2013

ACARE

perceived noise

ACARE / SRIA / Flightpath 2050

The perceived noise emission of flying aircraft is reduced by 65%. These are relative to the capabilities of typical new aircraft in 2000.

100 %

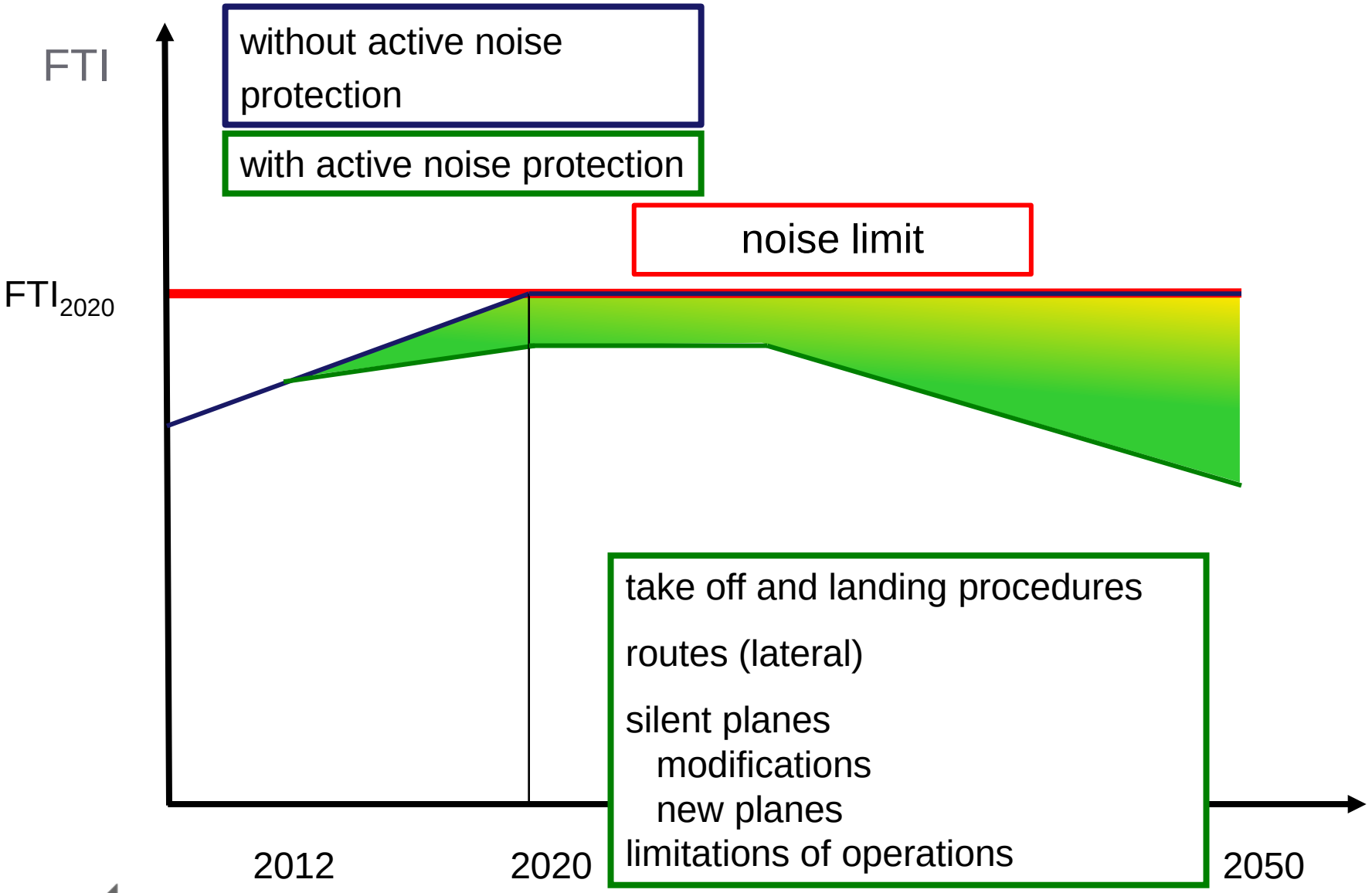
35 %

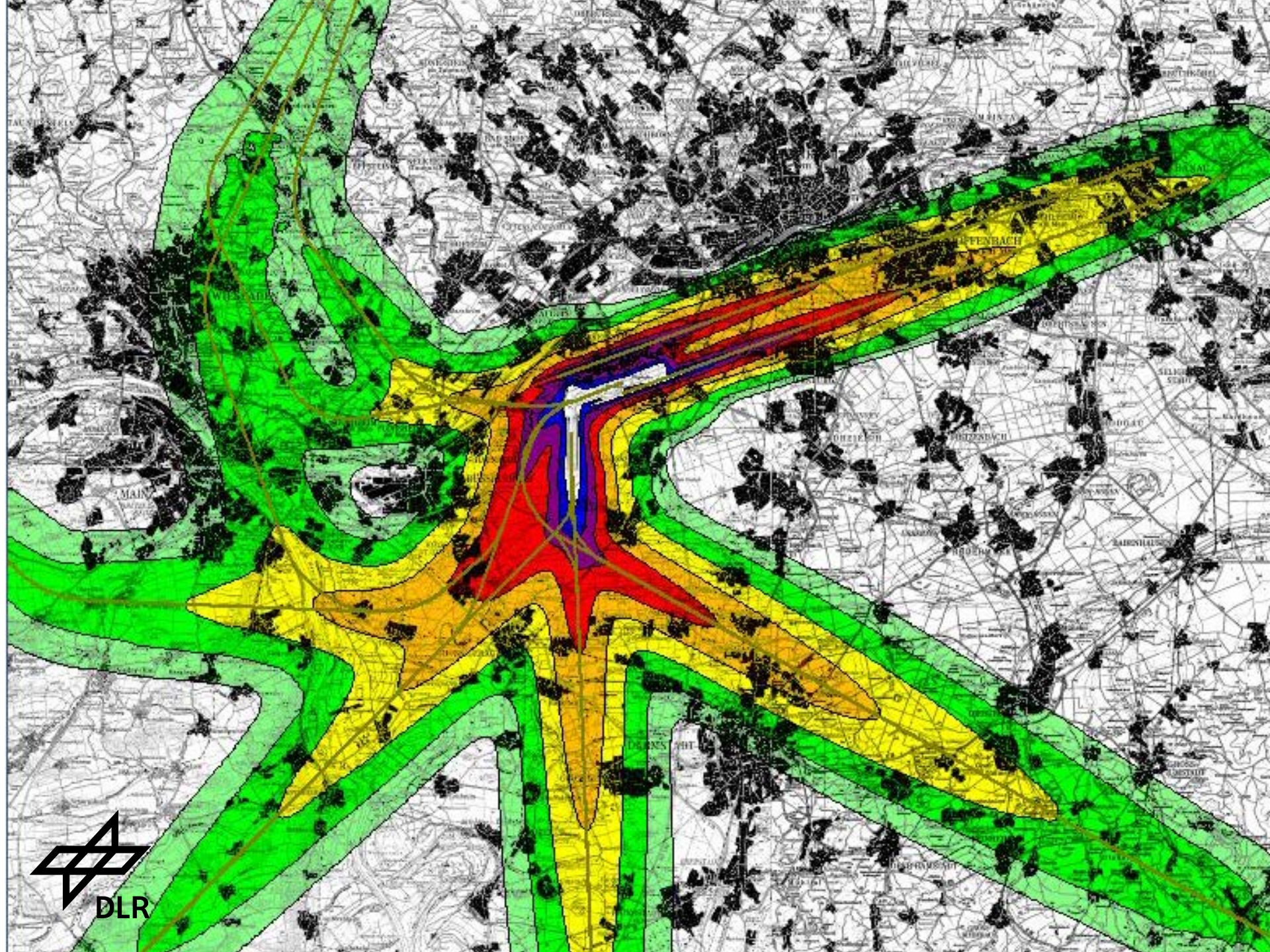
2000

2050

DLR

2013 development noise index

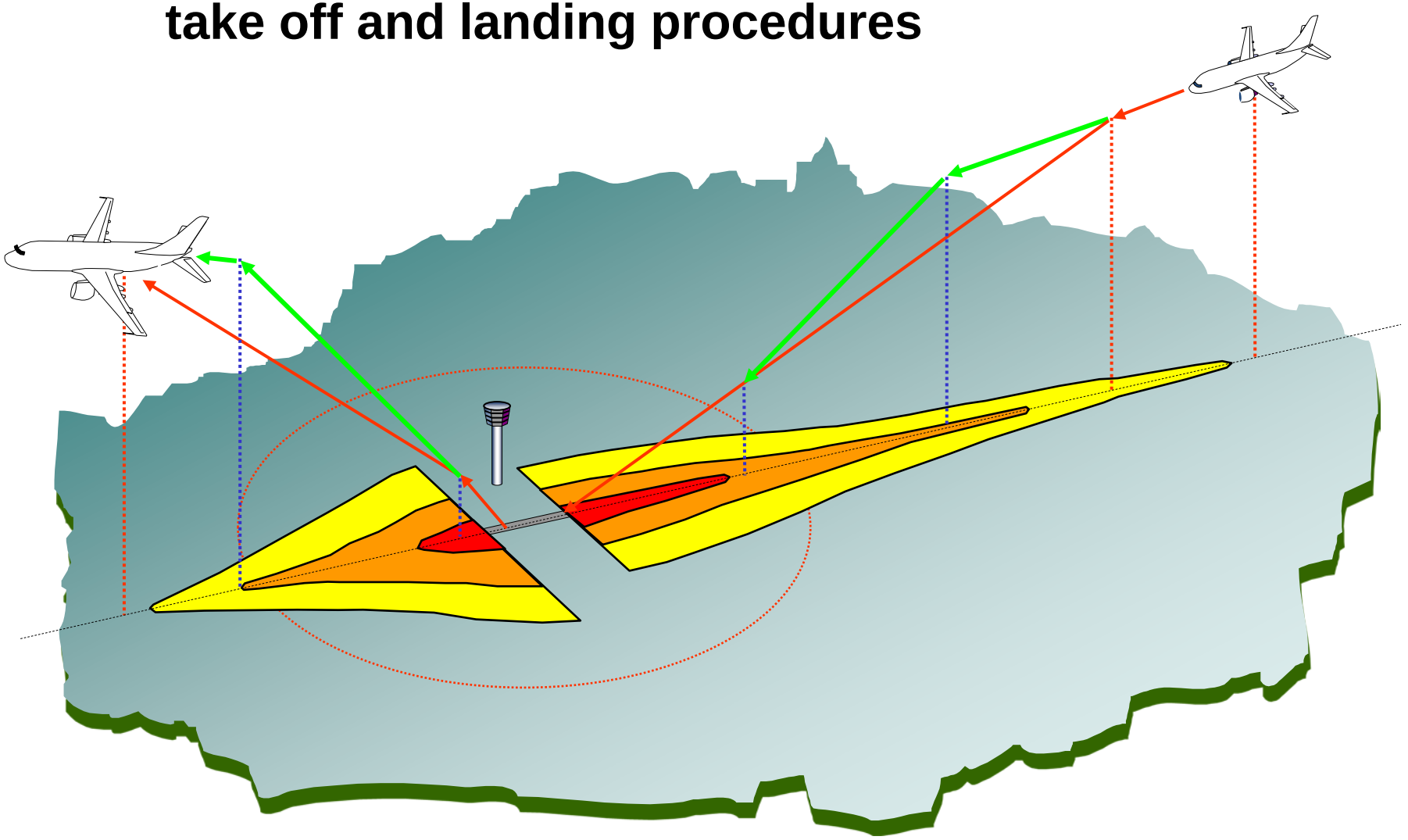



DLR

Segmented RNAV-Approach with GBAS

DLR

take off and landing procedures



DLR

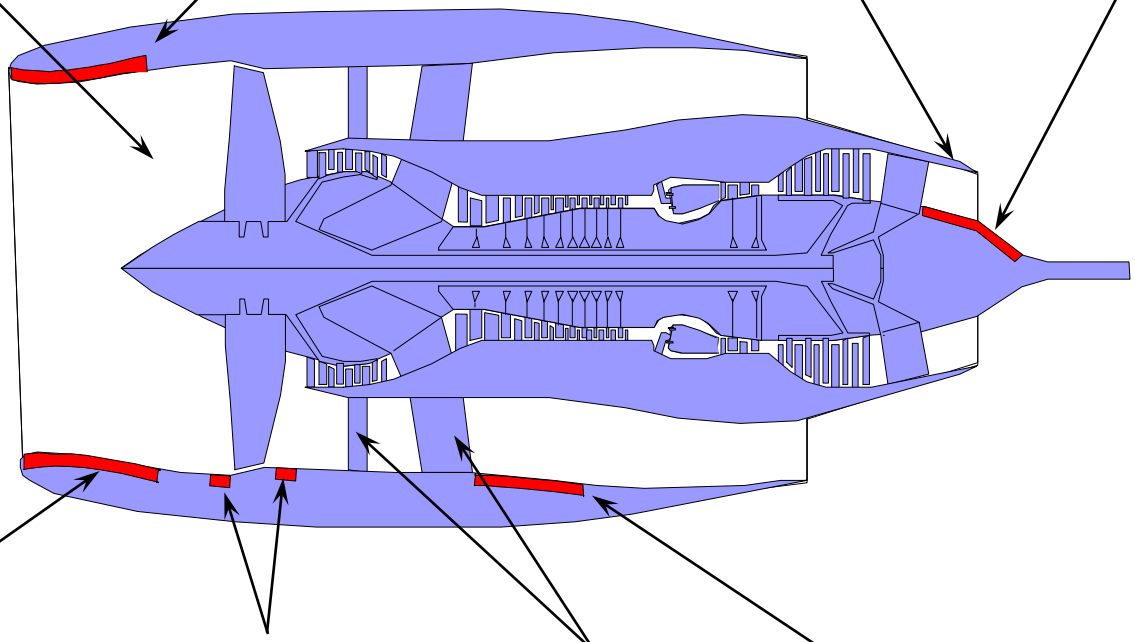
Advanced noise reduced engine technologies

Integrated aeroacoustic draft
(Intake / Rotor / Stator)

Adaptive noise absorber

Quiet nozzle

Hot air noise absorber



passive broad band noise absorber

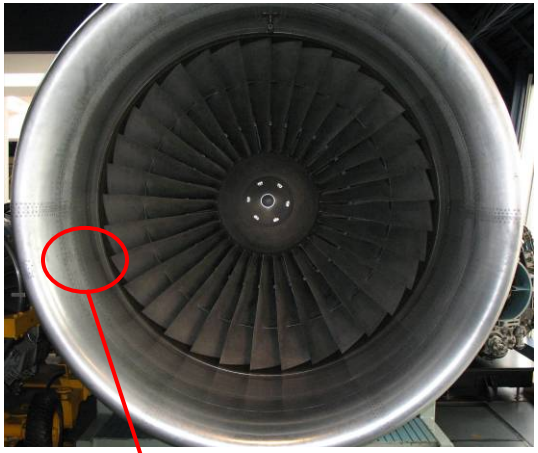
Aktive noise reduction

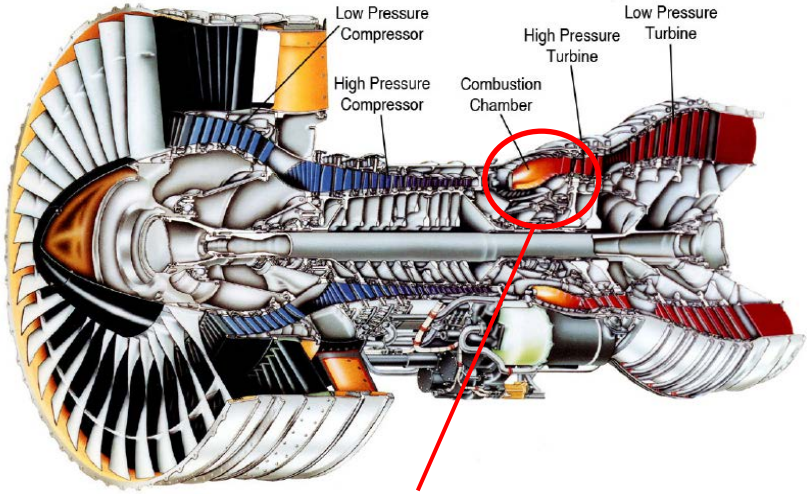
Aktive stator

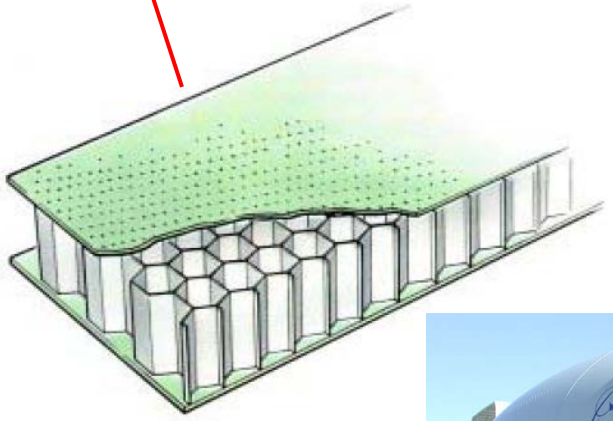
Aktive noise absorber

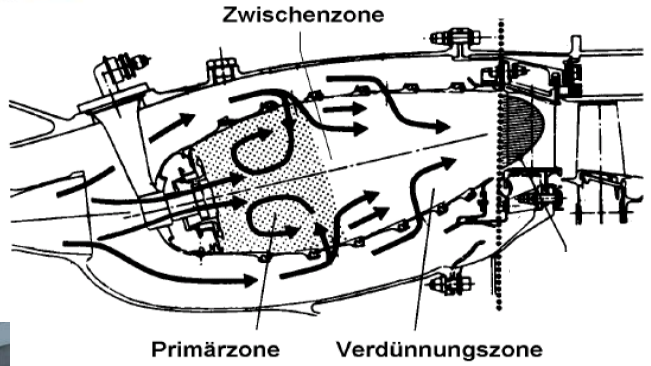
Quelle: EU

DLR





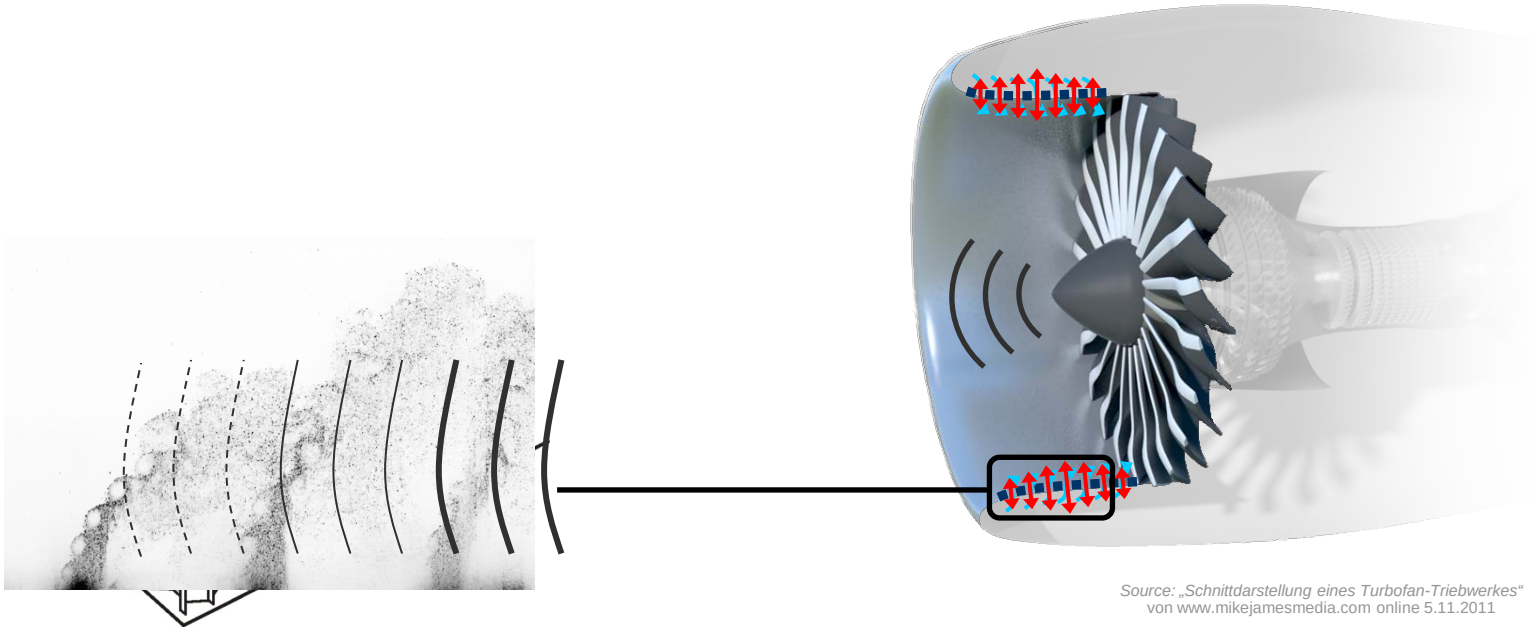




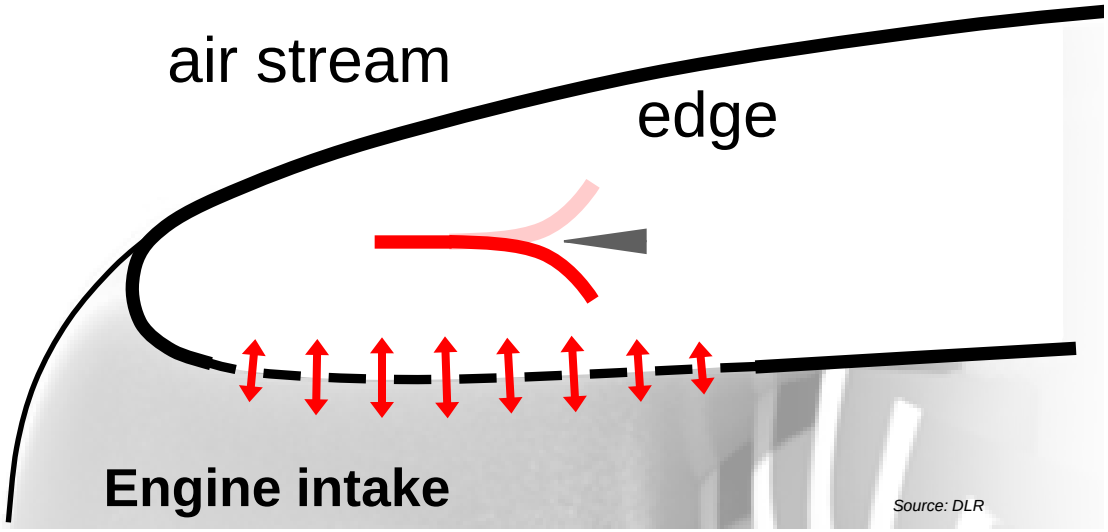
Sources: Boeing; Pratt &Wittney; DLR

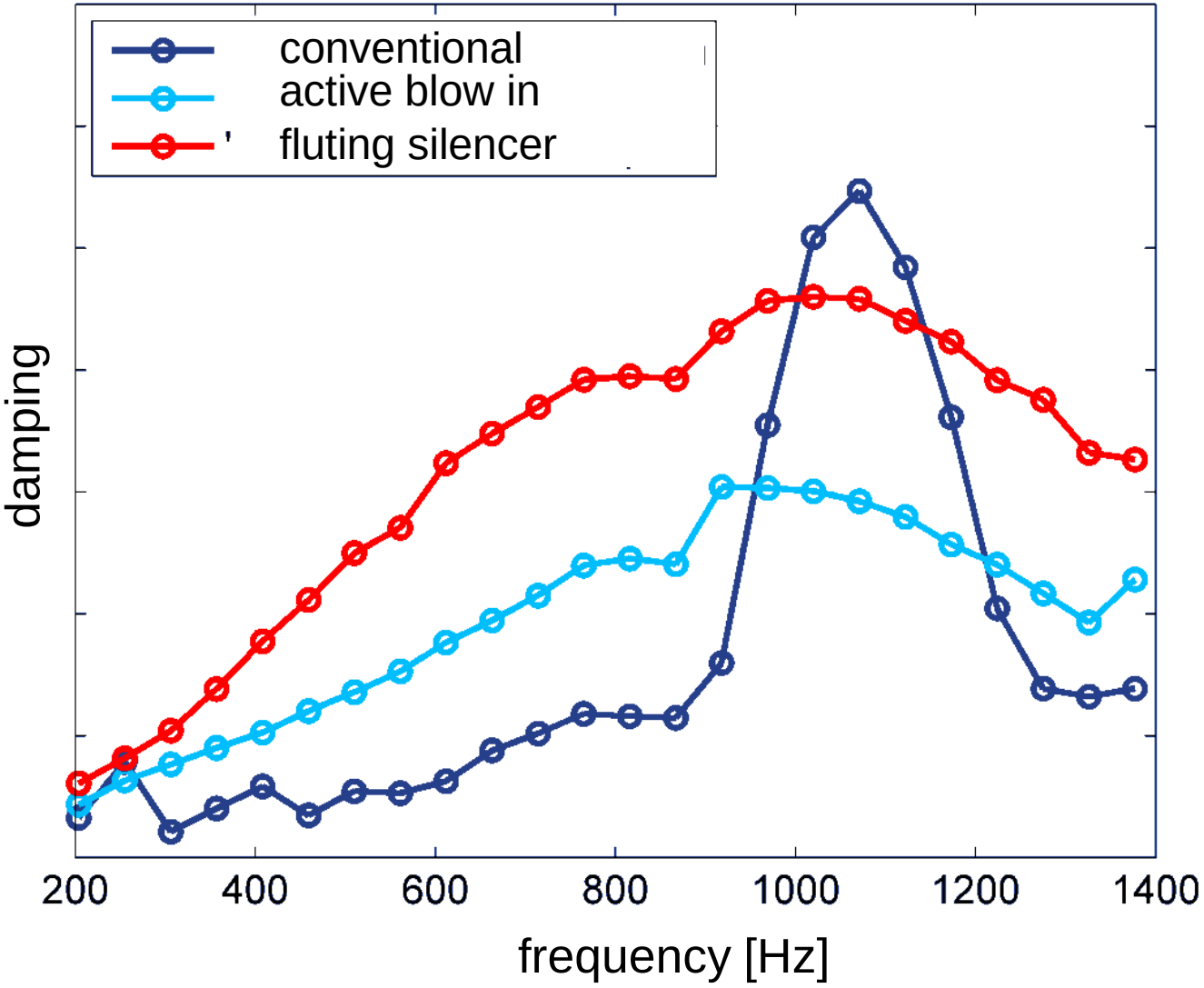
DLR

Silencer for aircraft engines



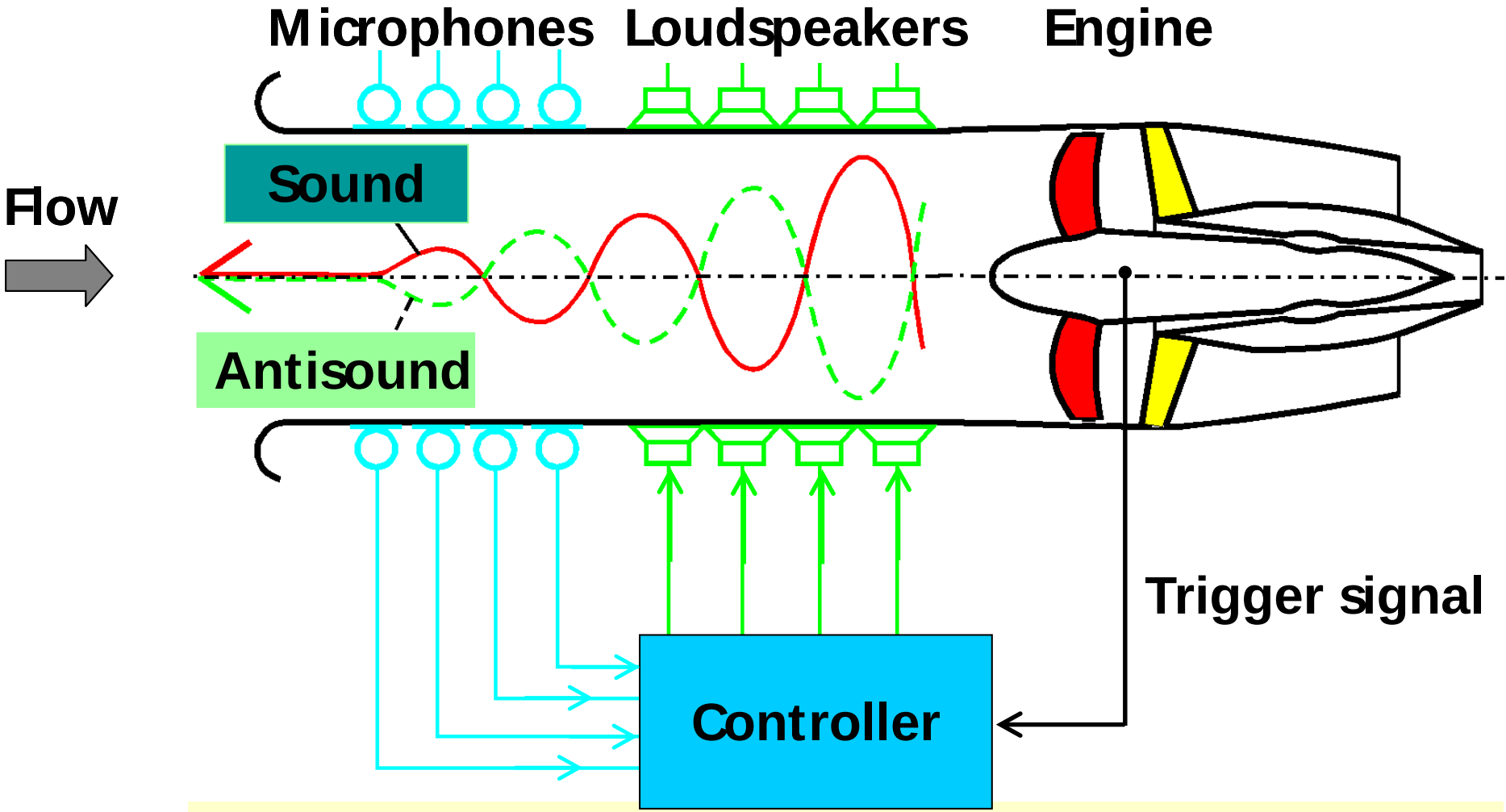
Source: „Schnittdarstellung eines Turbofan-Triebwerkes“
von www.mikejamesmedia.com online 5.11.2011


air stream
edge
Engine intake
Source: DLR

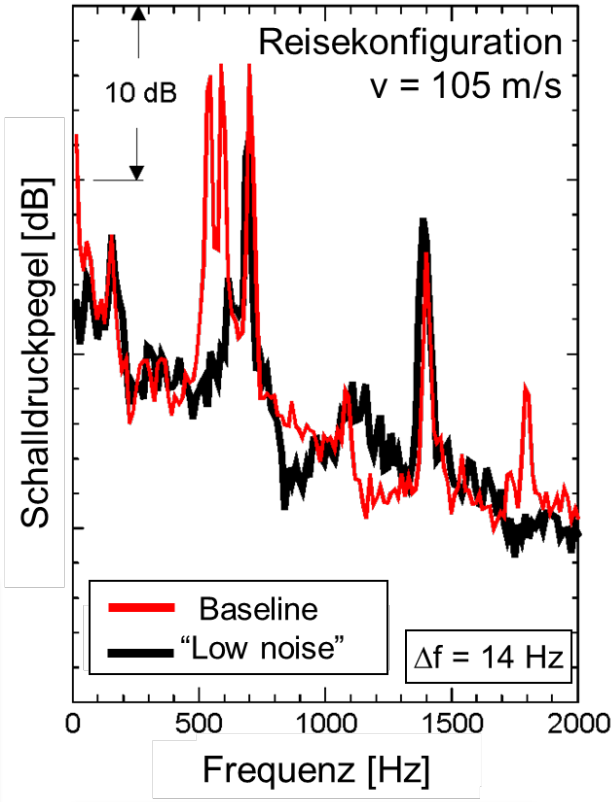


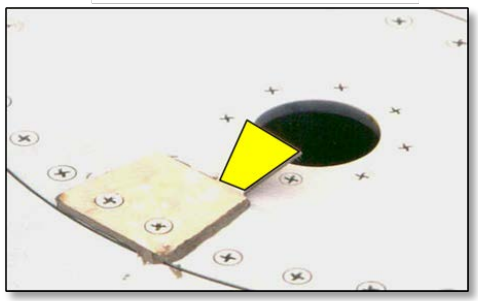
„Schnittdarstellung eines Turbofan-Triebwerkes“
von www.mikejamesmedia.com online 5.11.2011

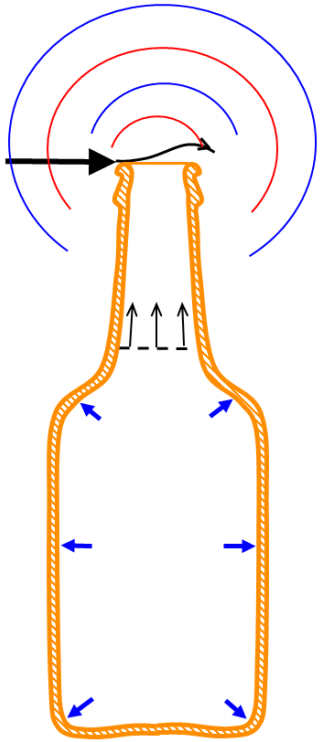
DLR


Microphones
Loudspeakers
Engine
Flow
Sound
Antisound
Trigger signal
Controller

parasitic noise sources

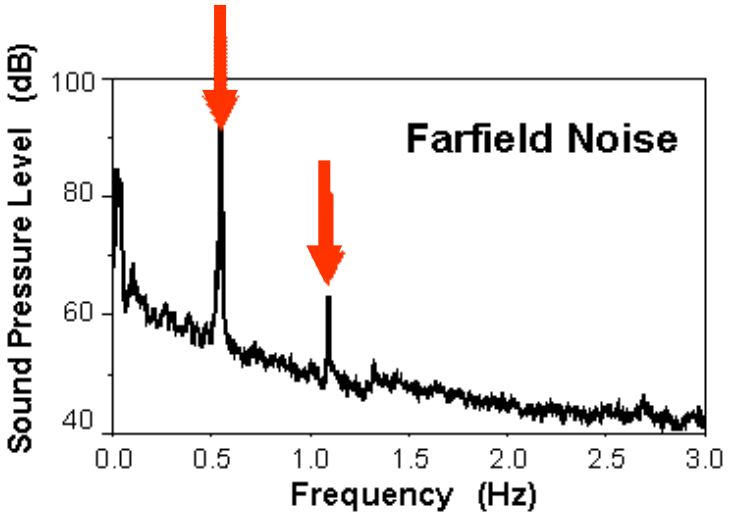


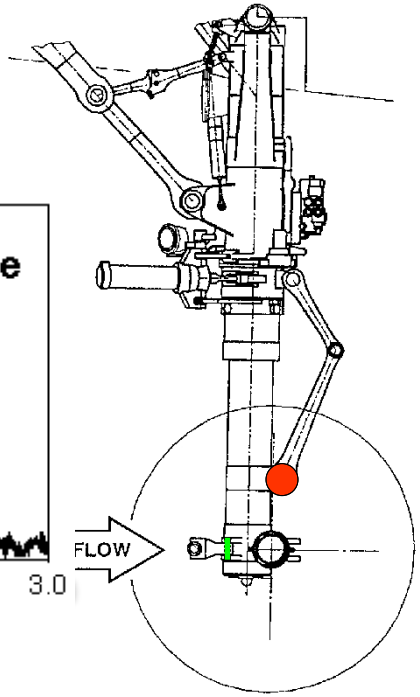




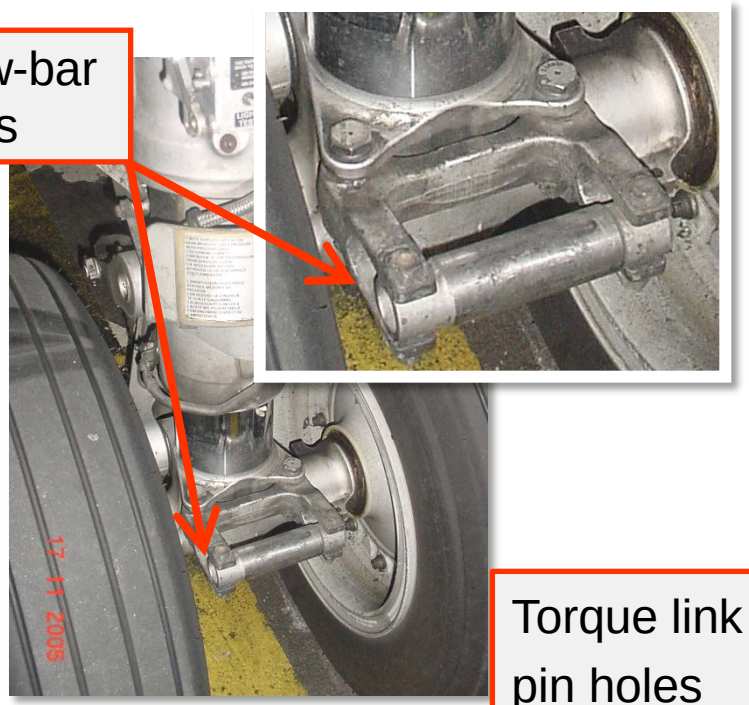
M. Pott-Pollenske et al. 2002

parasitic noise at landing gears





NLG tow-bar pin holes

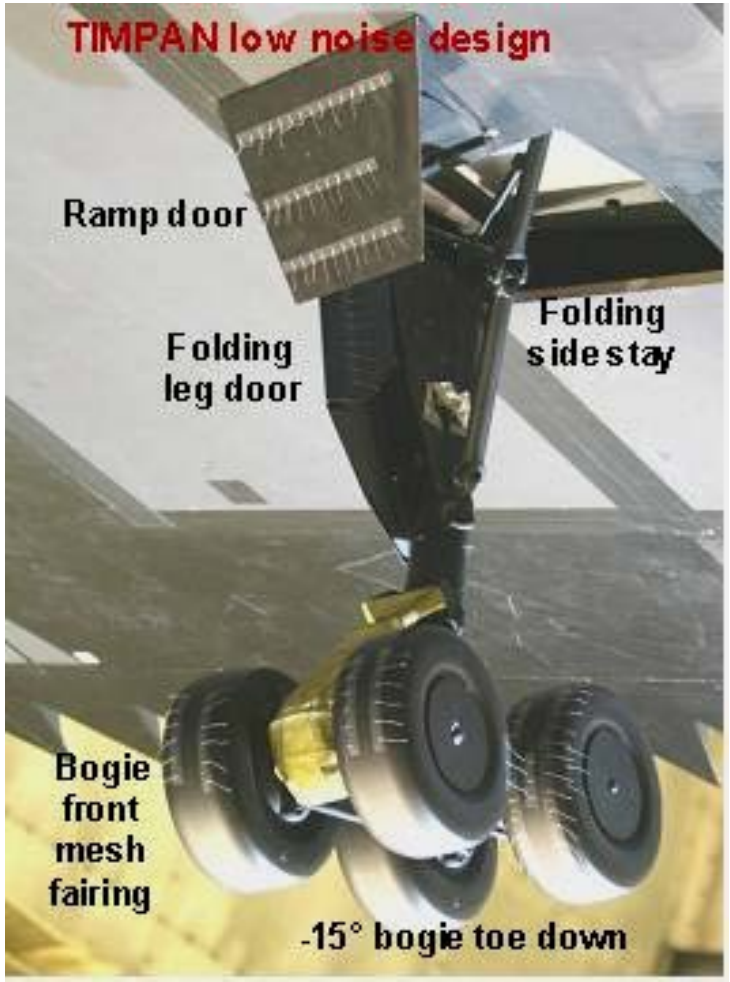


Torque link pin holes

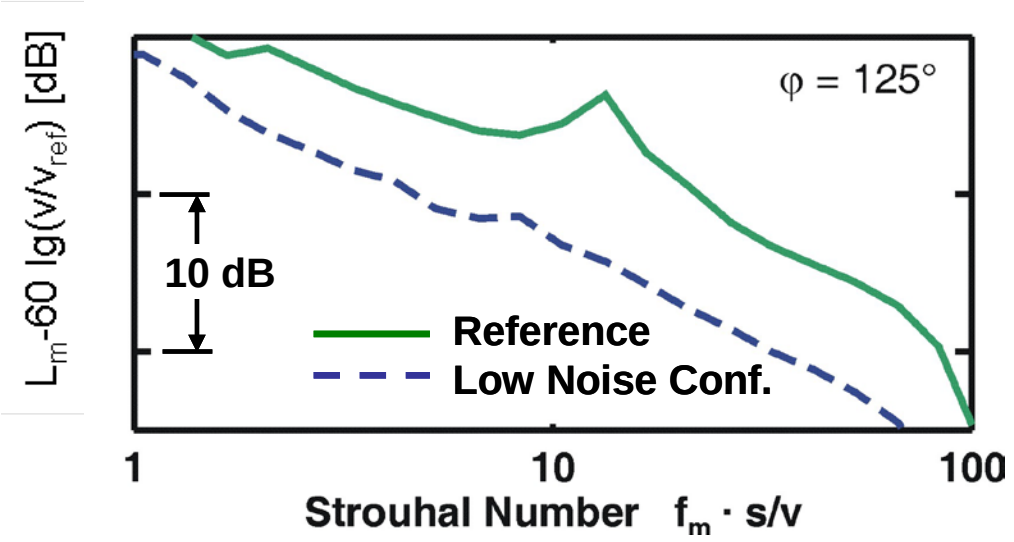
Dobrzynski 2010


SILENCER
DLR

noise reduction at landing gears



optimum combination of measures
→up to 8 dB(A) reduction



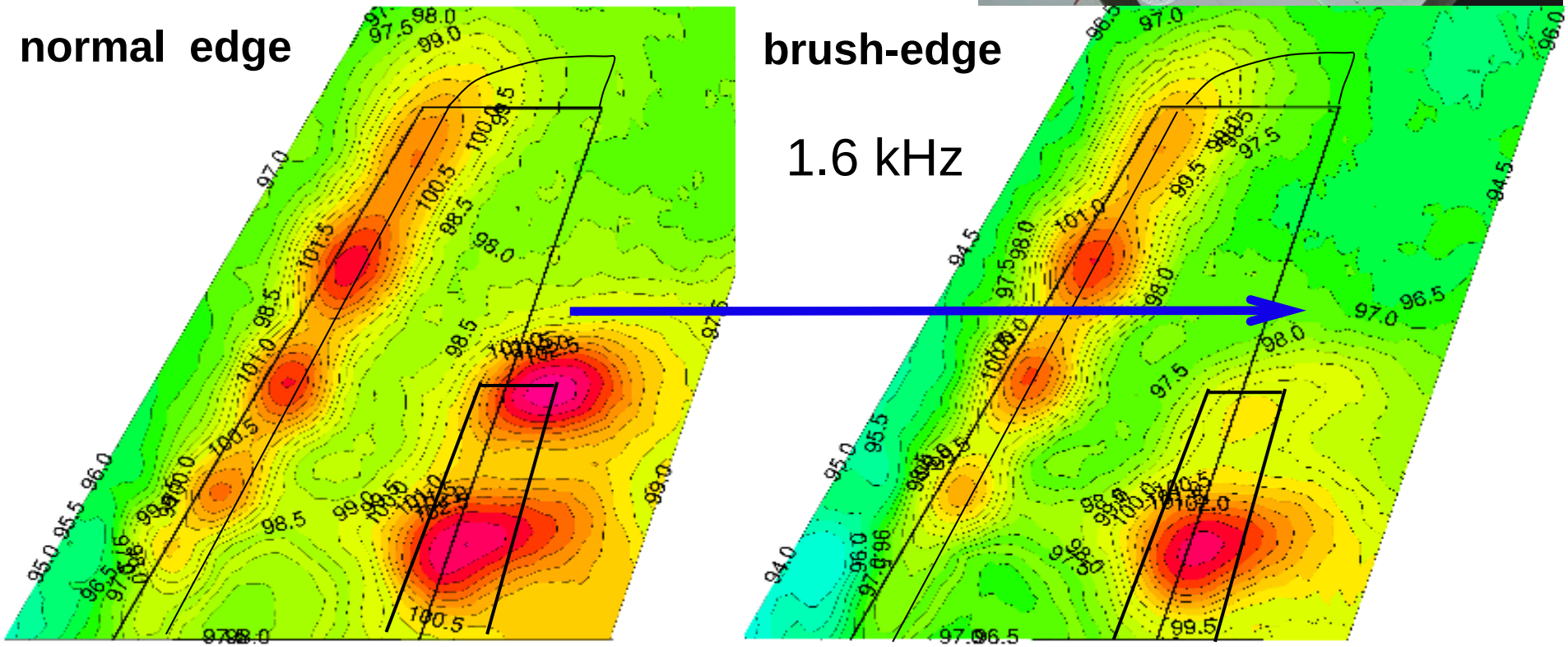
Dobrzynski et al. 2010

noise reduction technologies

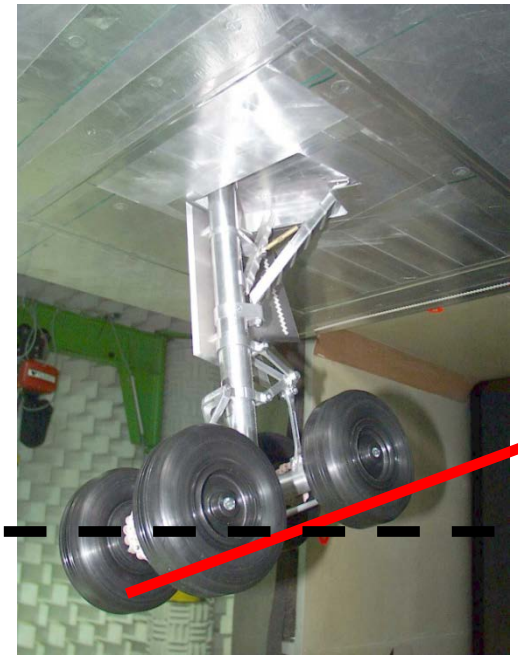
normal edge

brush-edge

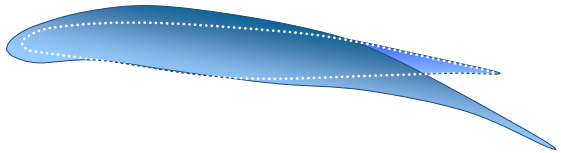
1.6 kHz



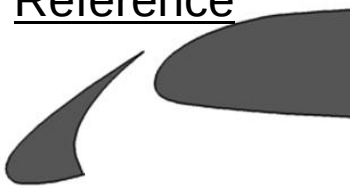
W. Dobrzynski et al. 2001



variety of measures



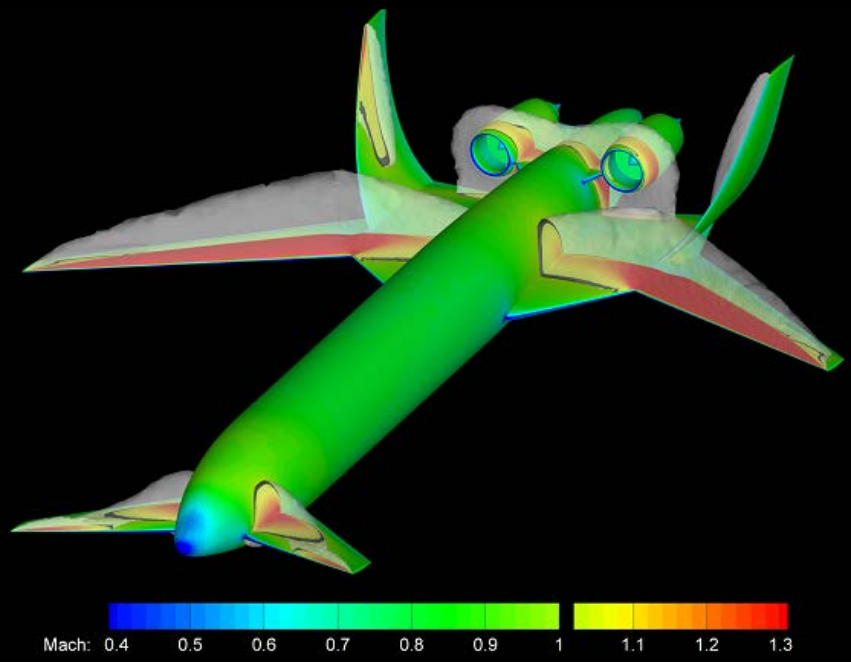
Reference



VLCS

DLR

concept study
for a silent plane



DLR

Roll-Out VFW614 5.4.1971 in Bremen

DLR

DLR-VFW 614 ATTAS

Advanced Technologies Testing Aircraft System

DLR

DLR Inflight simulator 1985-2012

DLR

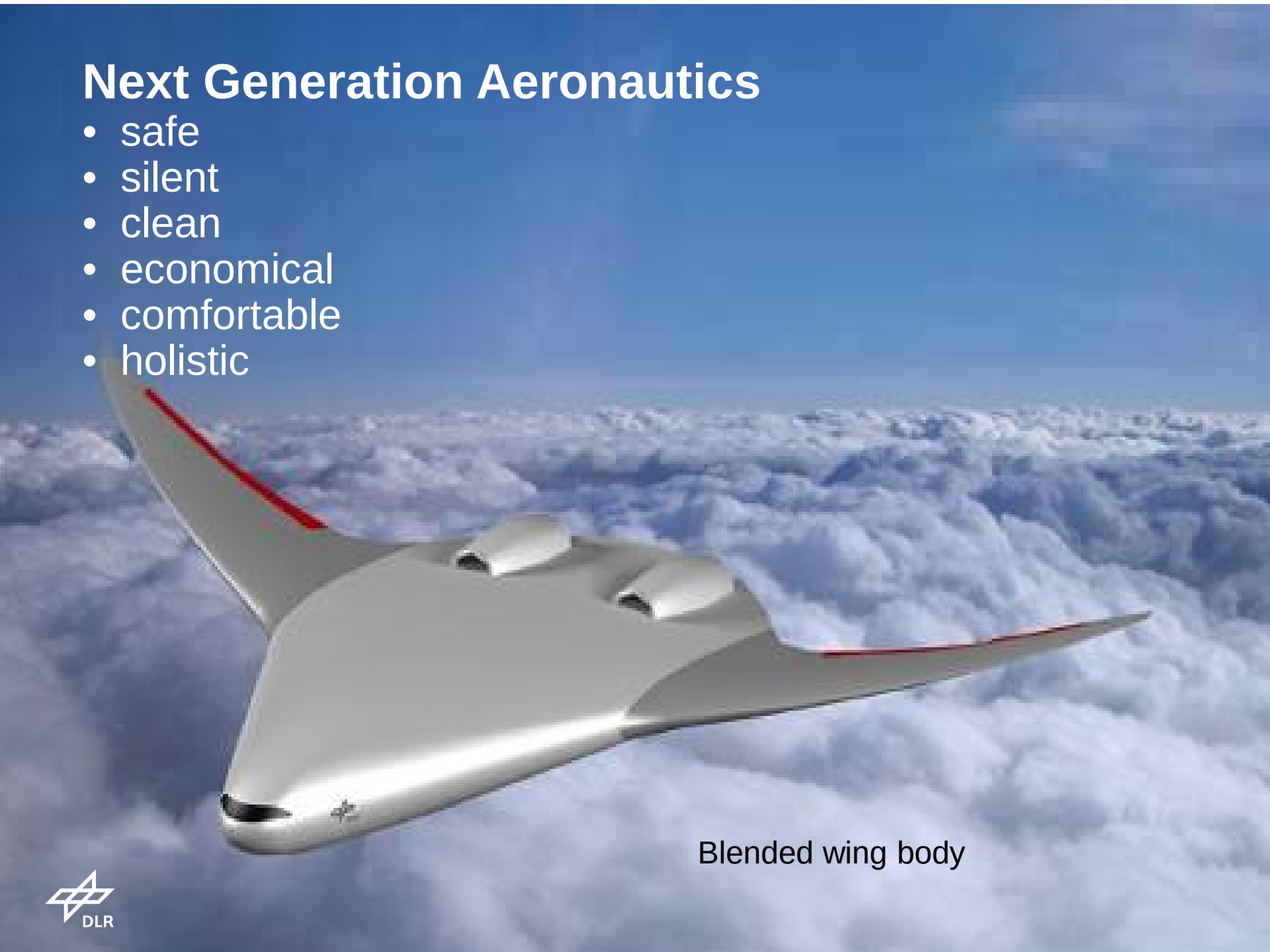
A 320
Multifunctional-fuel cell as APU

DLR


DLR
DLR

Next Generation Aeronautics

- safe
- silent
- clean
- economical
- comfortable
- holistic



Blended wing body

DLR

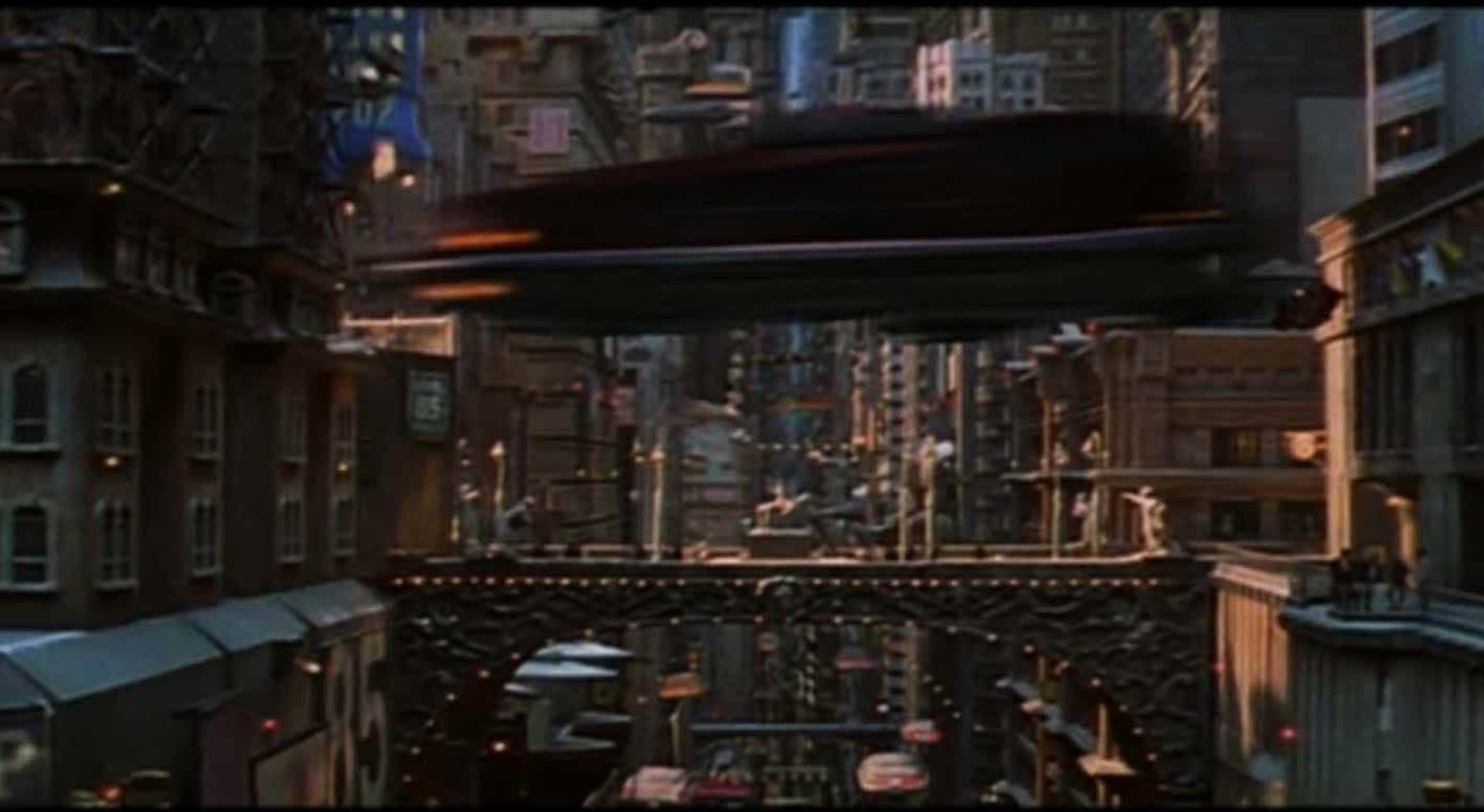
Conclusions

- Interaction necessary between optimized existing flying technologies and new, disruptive ideas
- Upgrading of existing technologies to reduce noise
- Same level of treatment of direct noise – engines – and indirect jet / turbulences landing gear
- Boundaries of actual technologies
- Necessity of disruptive technologies and technological revolutions
- Necessity of an holistic approach considering the aircraft and its environment

→ RESEARCH IS NEEDED!

- Driver: responsibility, incentives (financial, slots…), political decisions?

DLR



DLR

Knowledge for Tomorrow

DLR

4.4 Entwicklung leiseren Flugbetriebes durch neuen Technologien und Flugverfahren

4.4.1 Vortragende

Anne Dumoulin, Teamleiterin Operational Noise, Accoustics & Environment Department EPA, Airbus Operations S.A.S.

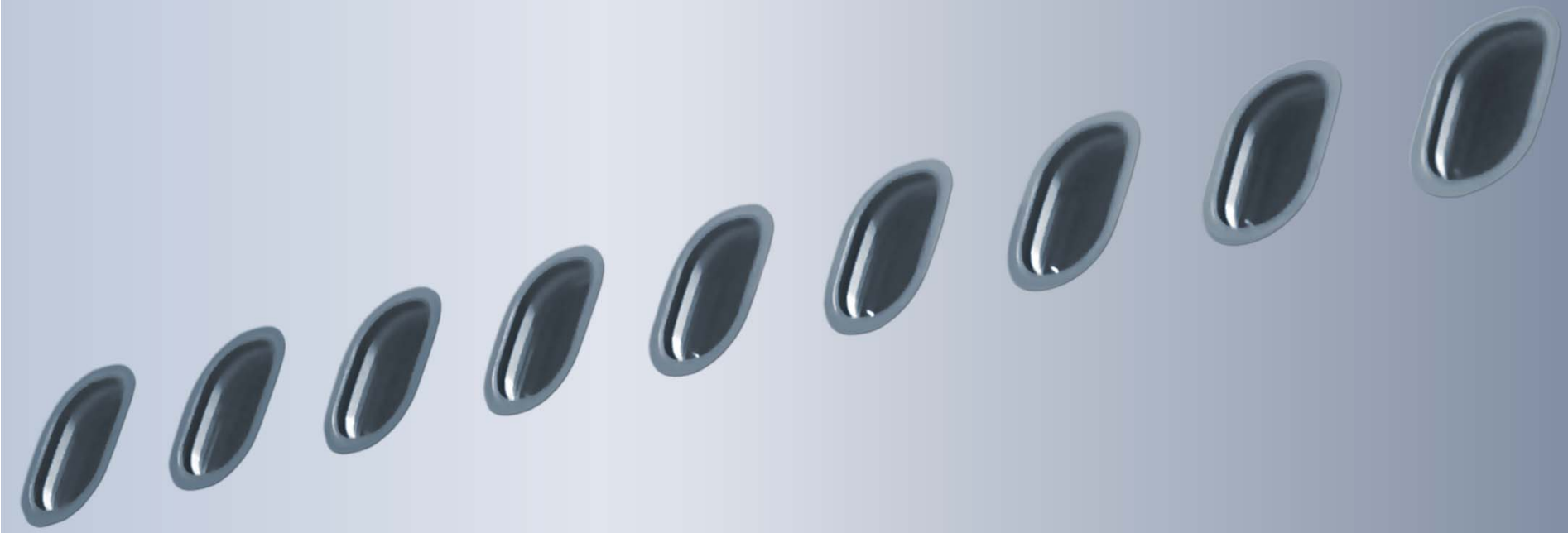
After 5 years in aerodynamic design domain, she has been working in the Acoustics & Environment Department as an Operational Noise Engineer since 4 years. Her job consists in reducing noise annoyance by optimizing operational procedure and more particularly, the approach phases with steeper approaches. The implementation of new concepts involves a multi-disciplinary activity to take into account all constraints (environmental benefits, aircraft capability, International authorities agreement, pilot's sensitivity,...)

4.4.2 Präsentation

Link zum Mitschnitt der Präsentation:

Deutsch: http://www.youtube.com/watch?v=ps9jc9boZ-U&feature=youtu.be

English: http://www.youtube.com/watch?v=XZaefVw8VBs&feature=youtu.be



ICANA 2013

Developing quieter aircraft operations through technologies and flight management

An aircraft manufacturer point of view

Presented by
Anne Dumoulin/ Operational Noise Engineer

AIRBUS

Scope

- Airbus Acoustics Engineering Activities
- Aircraft Noise Management & Regulations
- Current and Future Aircraft Noise Design
- Noise Abatement Procedures Concepts
- Conclusions

Scope

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Acoustics within Airbus Design Office

Acoustic activities in Airbus :

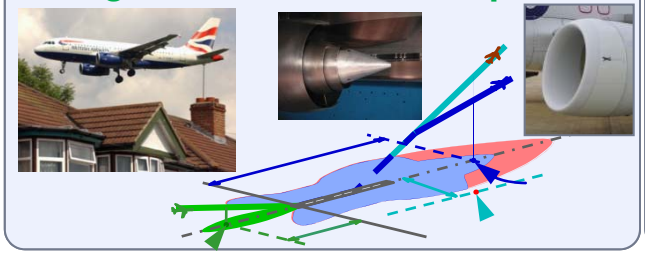
- Design Office : Toulouse and Hamburg
- Test Center : Acoustic and Vibration test laboratory in Toulouse (Blagnac)

Acoustic Design office mission :

Enable & support development of competitive and innovative A/C solutions fulfilling acoustic regulatory requirements, customer expectations and business challenges.

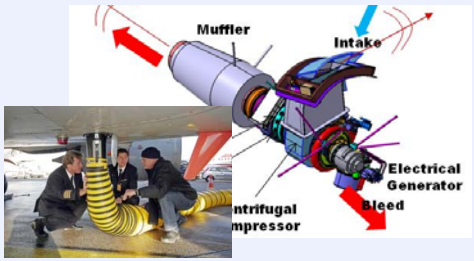
Three types of noise considerations :

Community noise :
Design, certification and operation



Interior noise : cabin & cockpit

A/C : Ramp noise



Acoustics within Airbus Design Office

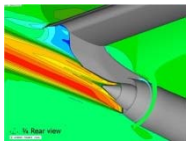
Acoustic activities cover the whole aircraft program lifecycle :

R&T ; M&T Predevelopment
Prepare our future challenges

Development
Prediction
Drive multidisciplinary noise design

Certification V&V
Demonstrate compliance

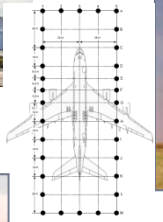
Series
Support In-service A/C, Cont Dev and Operations










Scope

- Airbus Acoustics Engineering Activities
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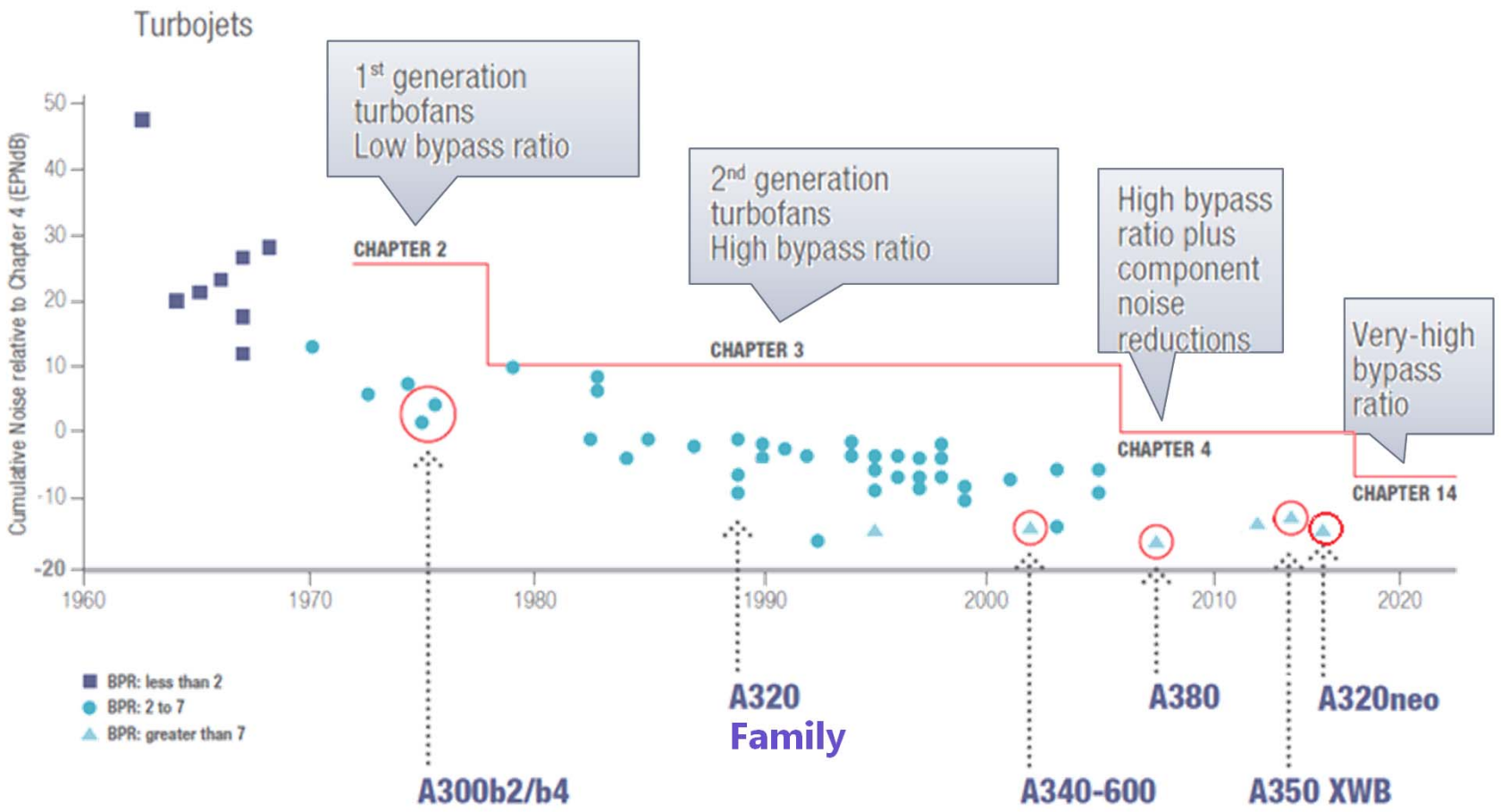
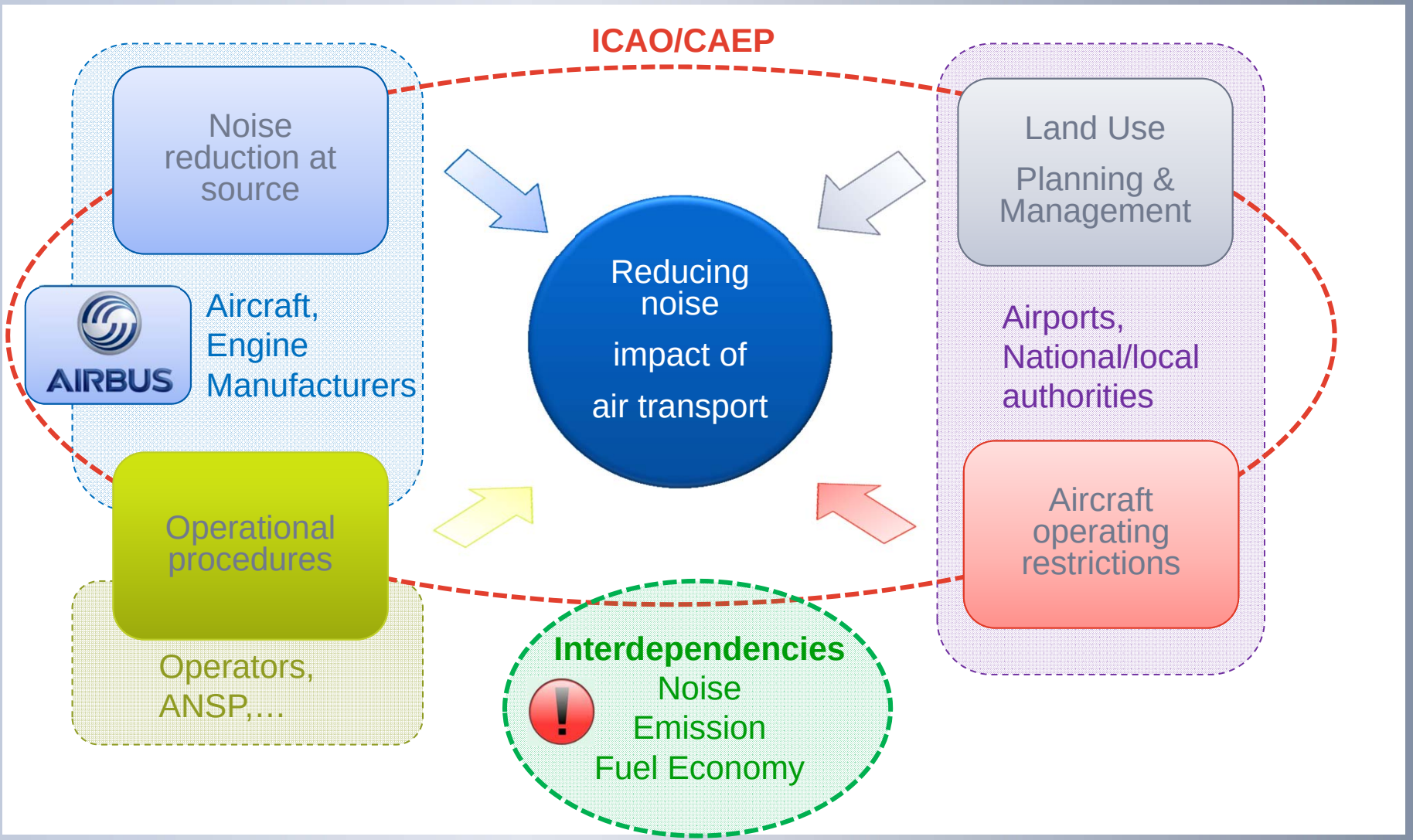
History of Increased Noise Stringency & Airbus Noise Reduction Achievements

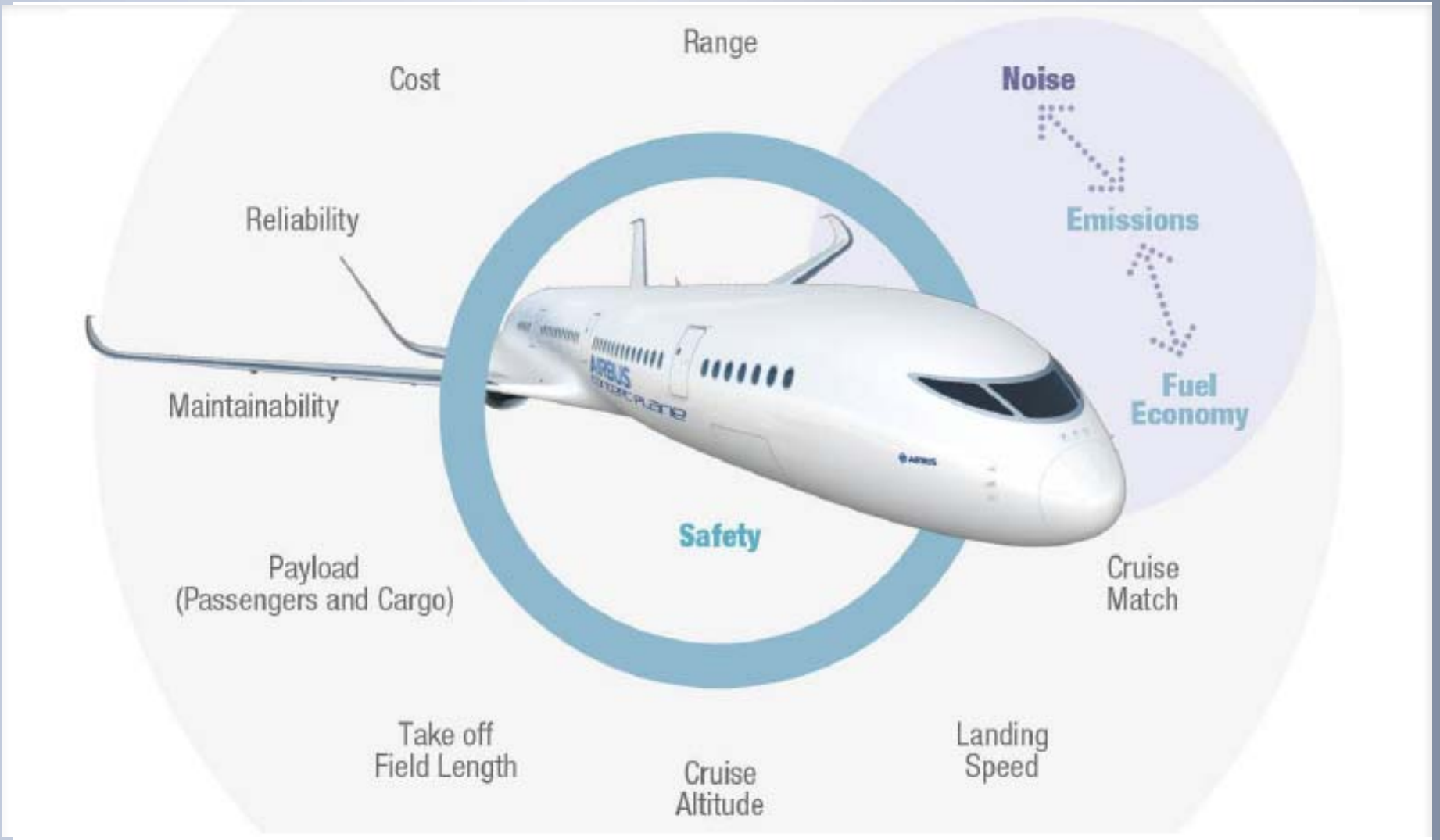


Balanced approach to A/C noise management

ICAO resolution A33-7, voted in October 2001



Airplane Design: a Balance of Various Objectives



Scope

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Benefit of current Airbus A/C In Service
A380-800

The double-solutions: capacity + technology

The A380 offers the biggest change yet in noise reduction technology at airports. It can carry 42% more passengers than the previous generation large aircraft but produces more than half the noise energy when taking off and landing.

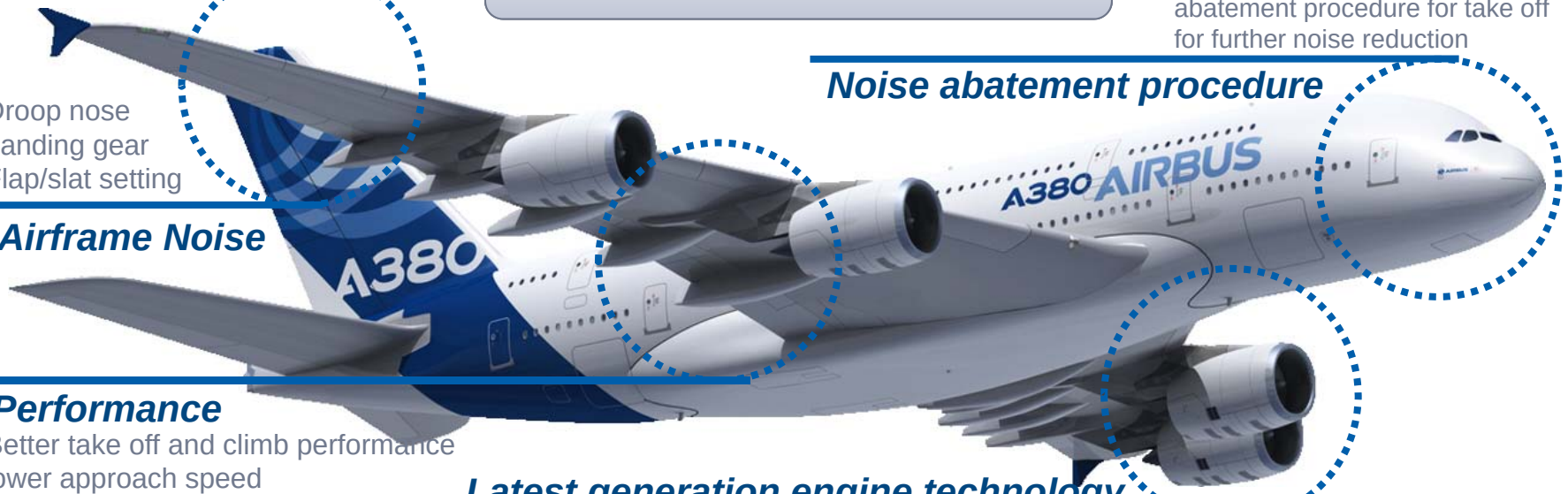
~ 17 EPNdB below Chapter 4

Automated and customised noise abatement procedure for take off for further noise reduction

Noise abatement procedure

Droop nose
Landing gear
Flap/slat setting

Airframe Noise



Performance

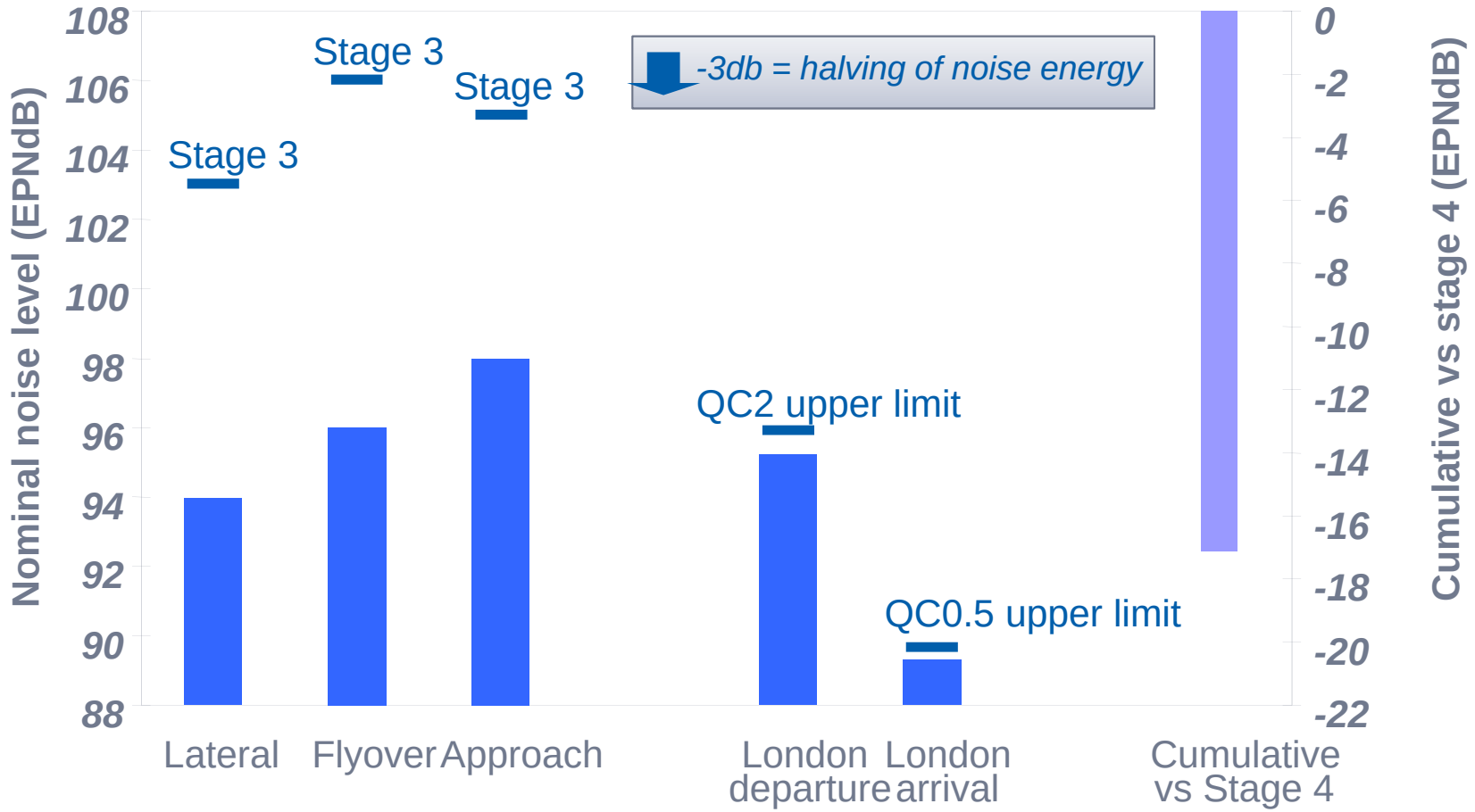
Better take off and climb performance
lower approach speed

Latest generation engine technology

Zero-splice inlet technology for engine nacelles
Low noise aero acoustic fan design
Advanced acoustic liners

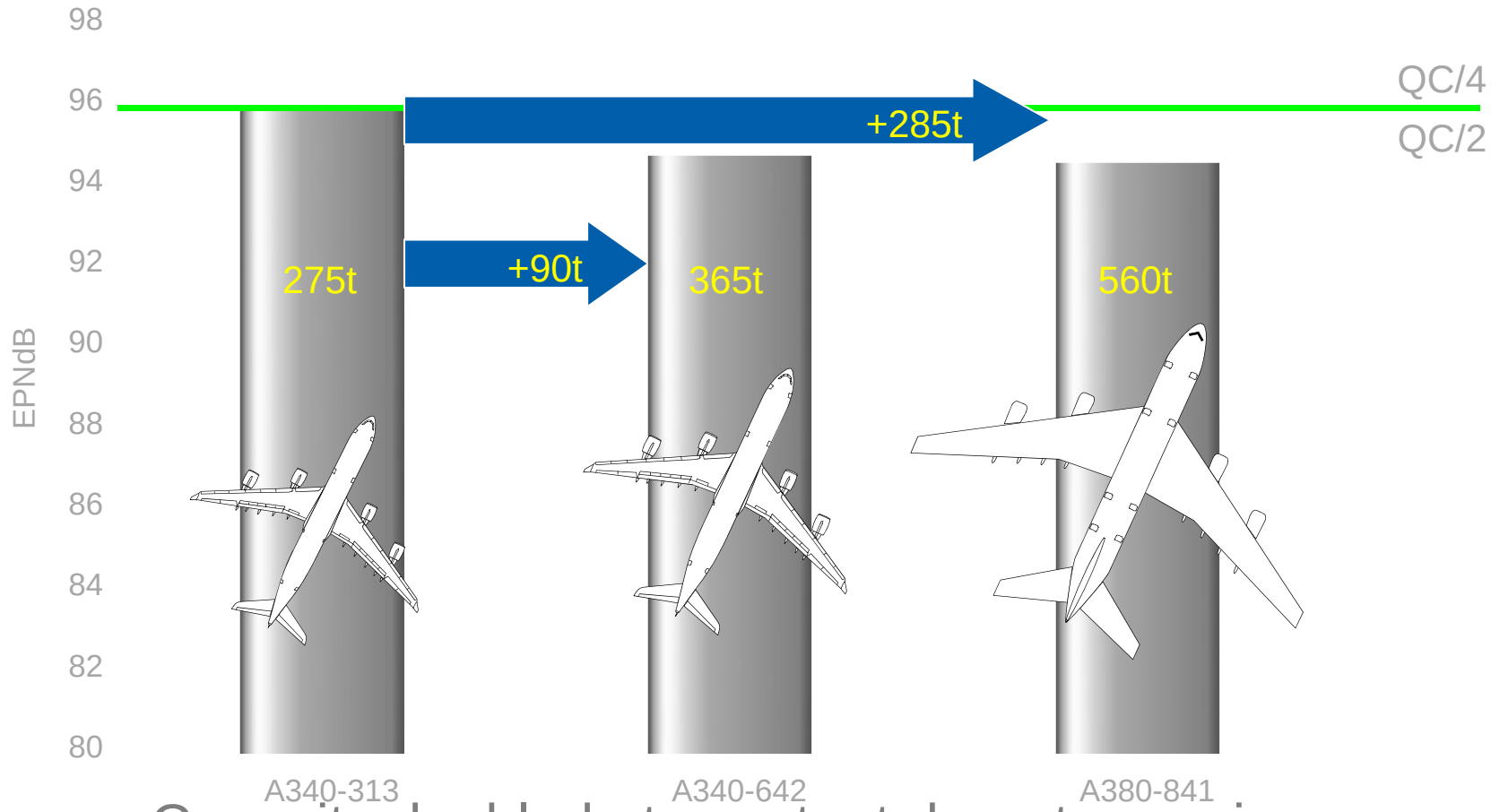
Benefit of current Airbus A/C In Service
A380-800 RR MTOW/MLW

Noise Status



Benefit of Current Airbus A/C In Service
A380-800

Capacity growth without noise increase : Departure



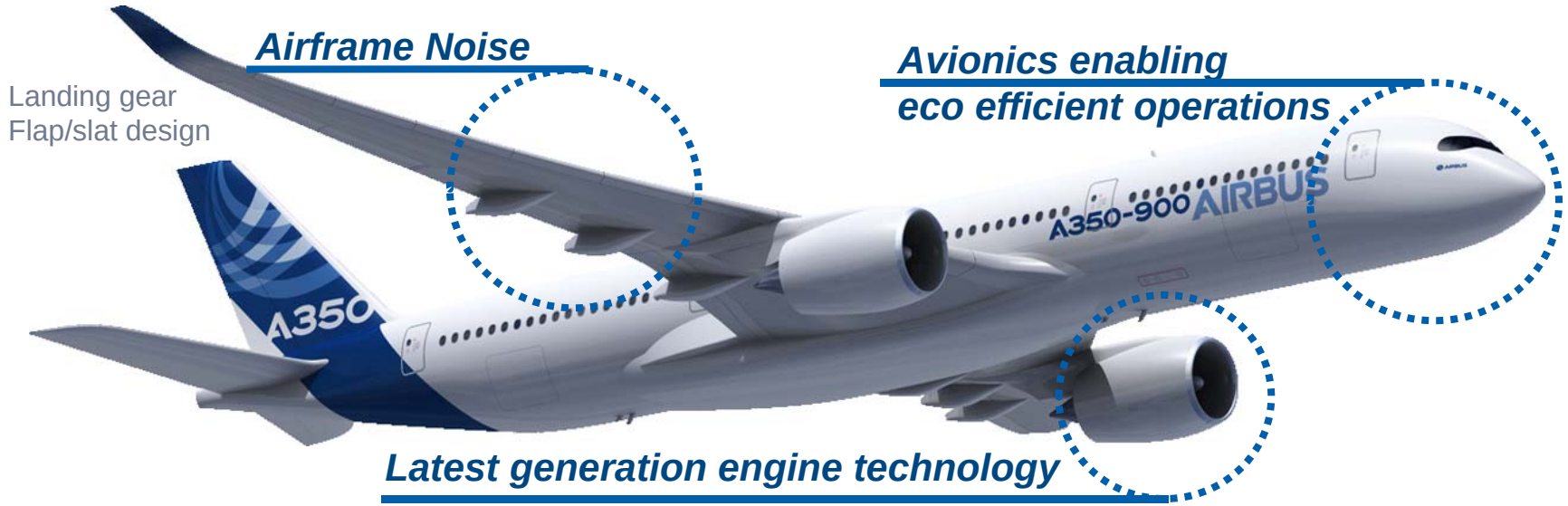
Capacity doubled at constant departure noise

Benefit of Current Airbus A/C Developments
A350-900 : EIS in 2014

Shaping eco-efficiency

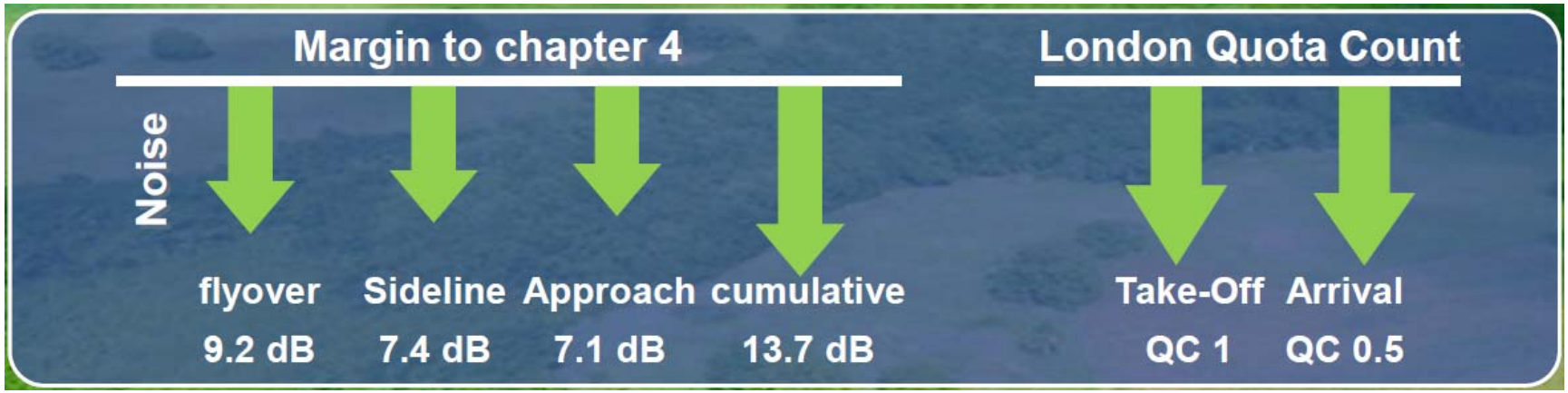
The A350XWB design benefits from the latest noise technologies such as higher bypass ratio engines, most advanced nacelle acoustic treatment technologies, airframe components noise design improvement, aircraft functions/systems for noise optimization in operations.

~ 14 EPNdB below Chapter 4



Benefit of Current Airbus A/C Developments
A350-900 : EIS in 2014

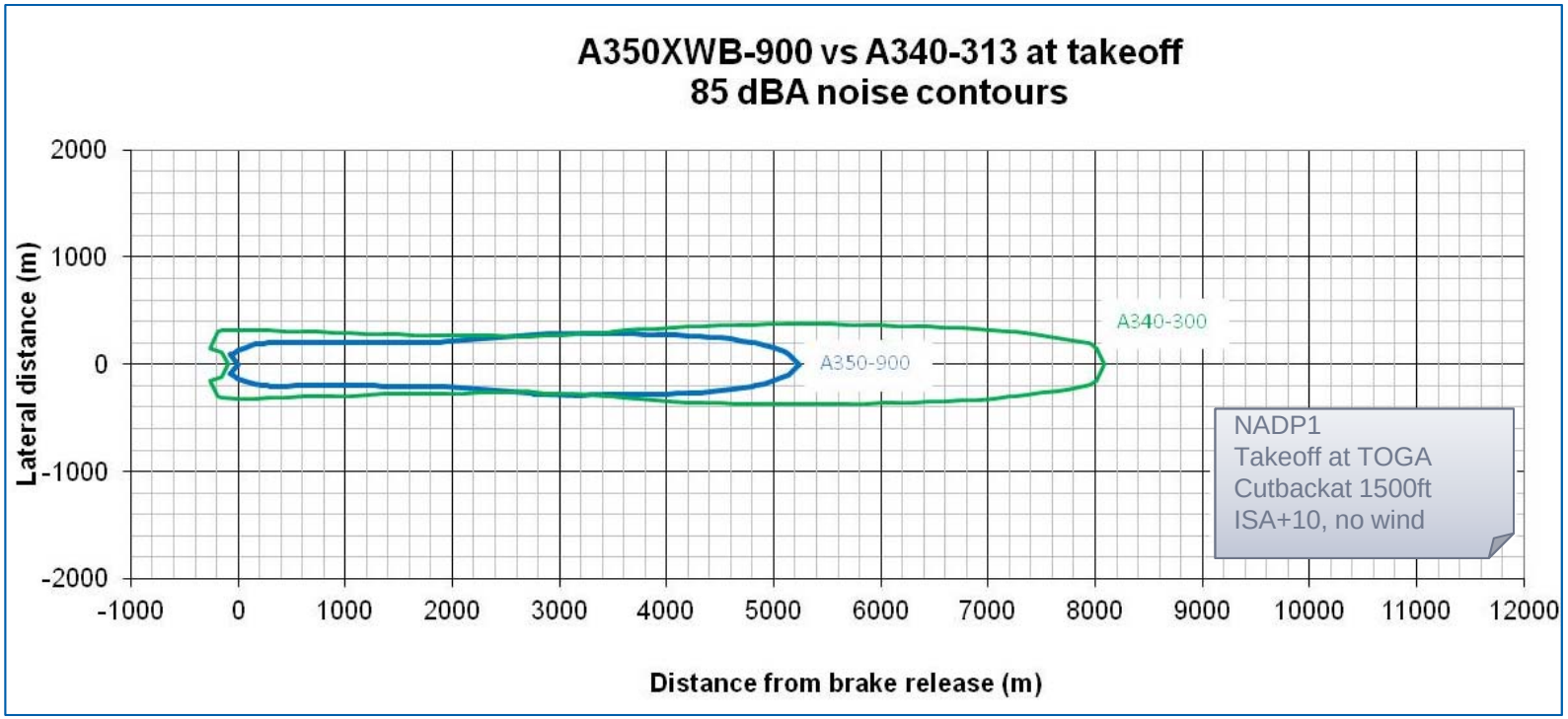
Noise Status



Data for A350-900, Trent XWB-84 engines, 268 tonnes MTOW

Benefit of Current Airbus A/C Developments
A350-900 : EIS in 2014

Noise benefit



Noise benefit compared to A340-300
About -7 EPNdB at take-off with 35 additional passengers

Benefit of Current Airbus A/C Developments
SA NEO : EIS in 2015 for A320 NEO

The new eco-efficient single-aisle

The New Engine Options for the A320 NEO offer high bypass ratio engines (PW GTF and CFM Leap 1A) with latest propulsion system acoustic design and technologies.

~ 15 EPNdB below Chapter 4

Sharklets

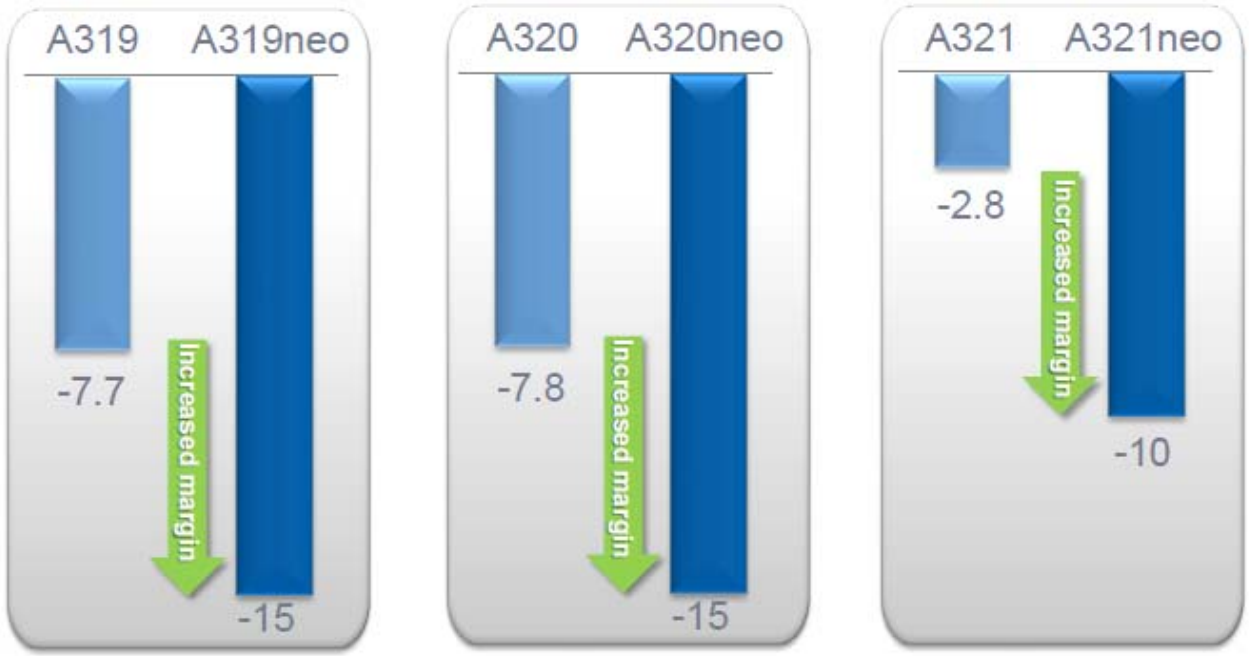
Improved aerodynamic performance

New engines

Bypass ratio 9 to 12
Up to 81 inch fan diameter
Lower noise levels

Benefit of Current Airbus A/C Developments
SA NEO : EIS in 2015 for A320 NEO

Target cumulative noise margin vs. Chapter 4 (EPNdB)



NEO noise benefit compared to current A320 Family

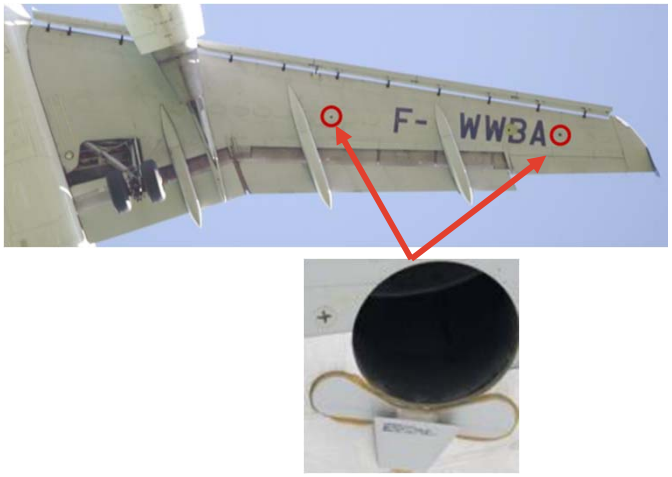
Serial Improvement

Sharklets : New wing tip devices developed to enhance low speed and high speed A/C performance.

Benefit vs. in-service SA family (with current wing tip fence) :
Up to -1 EPNdB in operational take-off conditions

SA Fuel Over Pressure Protector Vortex generators

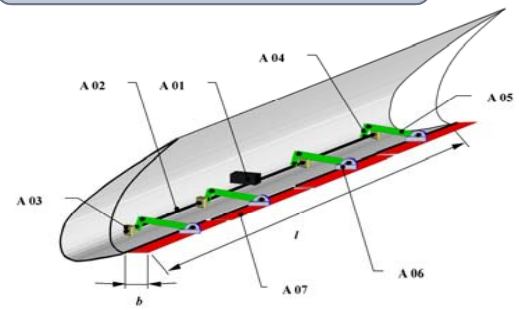
Benefit of vortex generators in approach conditions :
Up to -9 dBA in a speed range between 180 and 240 kts, corresponding typically to a distance between 15 and 50km from the airport



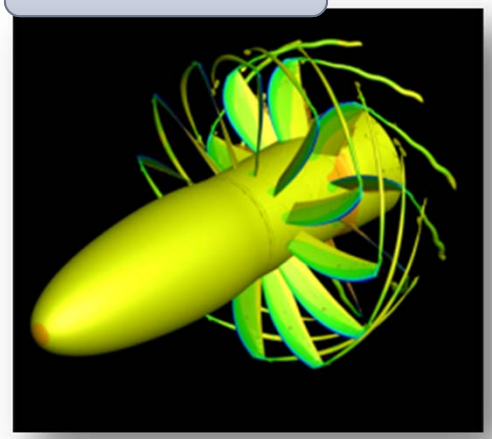
Next Steps for Design Optimization

Example of Future Low Noise Technologies

Slat/Flap techno

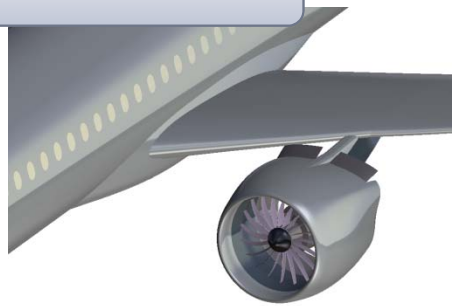


Open Rotor



Landing gear

UHBR



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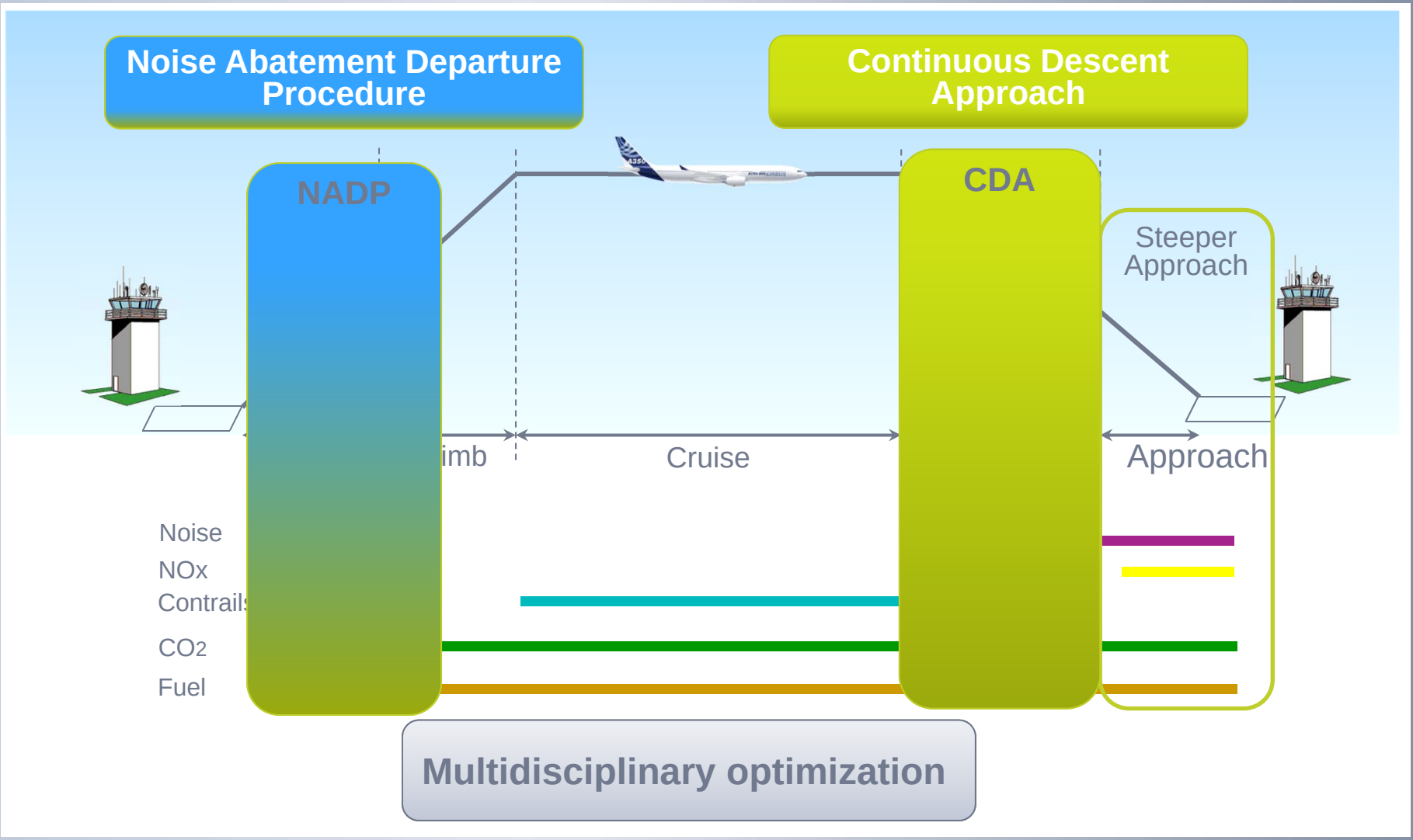
Optimization of Operational Procedures

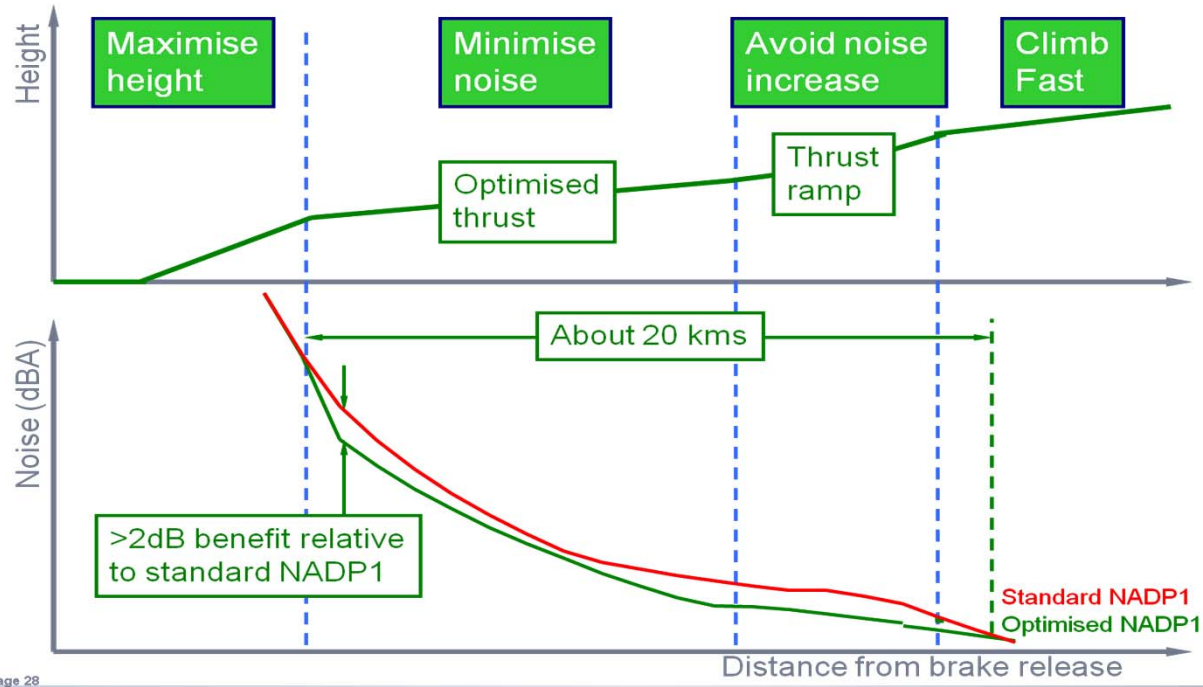


Optimization of Operational Procedures
Noise Abatement Departure Concept

Departure optimized function : A380 & A350 have a new automatic flight function to reliably & continuously handle NADP with optimum noise trajectories

Ambient conditions
Airport constraints & areas to be protected
Actual aircraft parameters

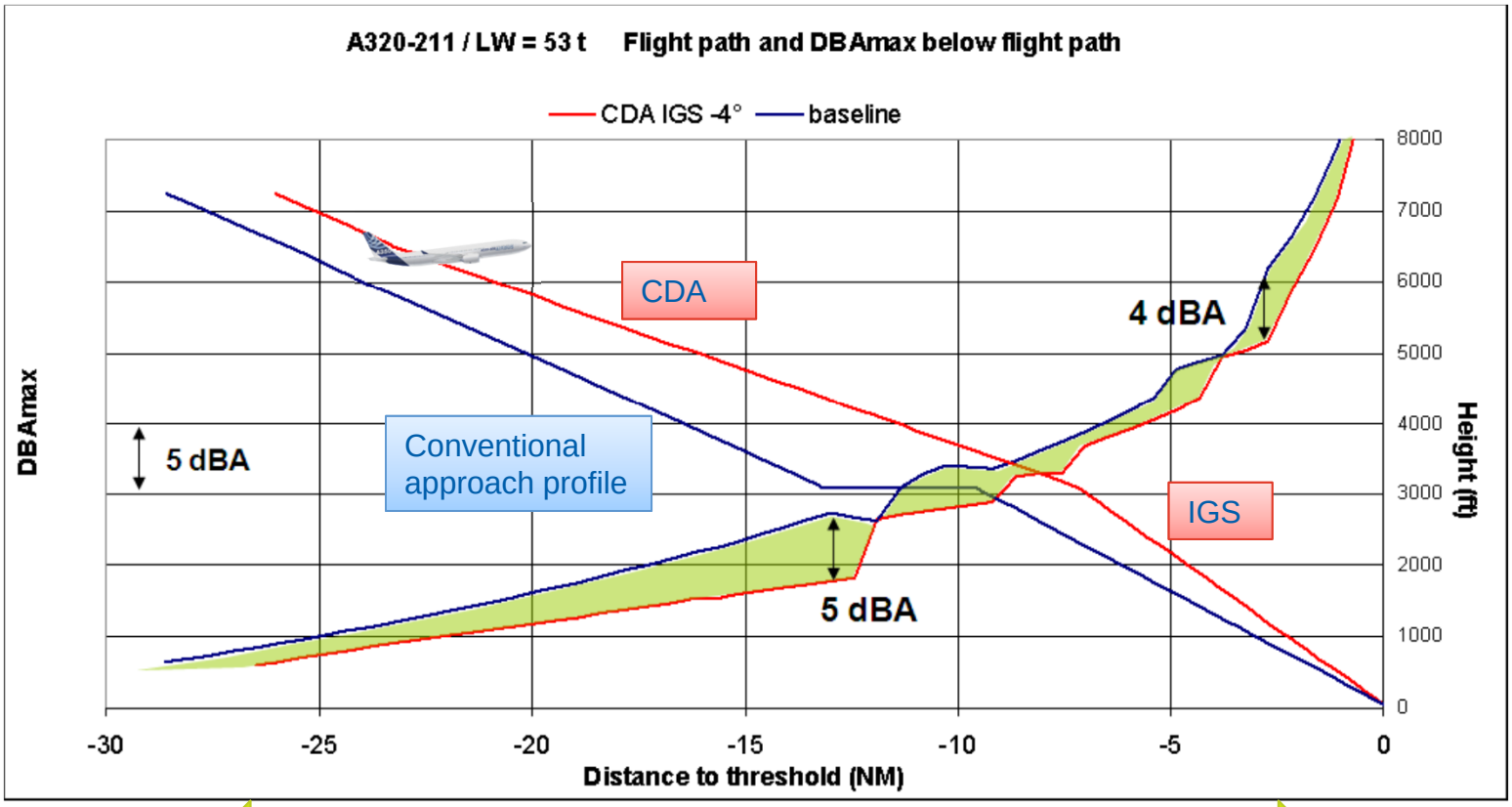
→ Airbus Departure Analysis Software (ADAS) → Optimised NADP In Flight management system



- Noise Thrust: Fixed thrust
- Noise Speed: Fixed speed
- Noise End Altitude (NEA): End of acoustic procedure
- Thrust ramp: Thrust transition from noise thrust to max climb thrust

Optimization of Operational Procedures
Noise Abatement Approach Concept

CDA with Increased Glide Slope (-4°)

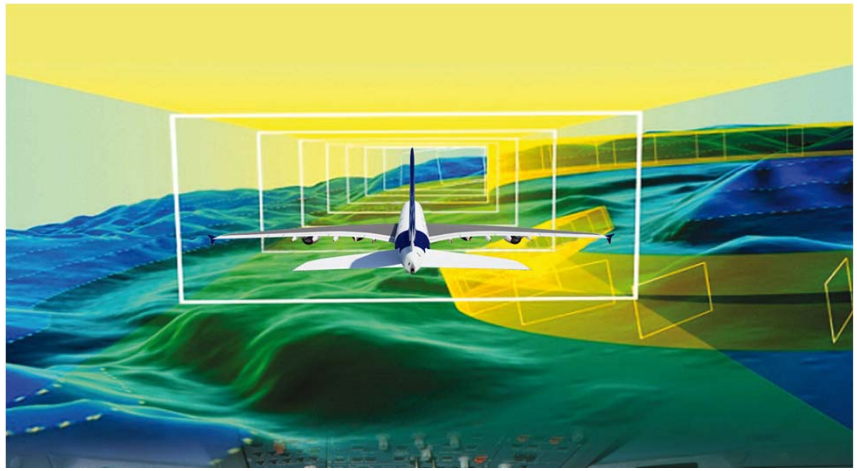


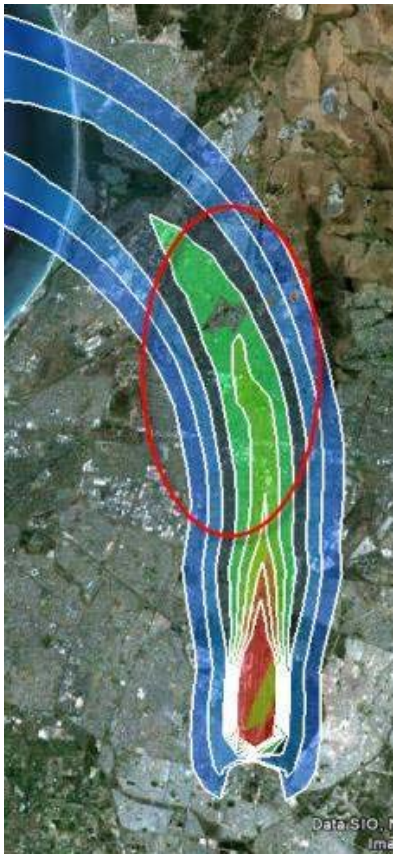
Large area of noise benefit
Noise relief: 5dBA intermediate approach, 4dBA final approach

Optimization of Operational Procedures
RNP for Noise Optimized Departure & Approach

Performance-Based Navigation (PBN) allows for the optimization of the procedure through the aircraft navigation performance.

Latest standard of Required Navigation Procedures (RNP) allows operations in very constrained environments with a combination of Lateral & Vertical optimization.



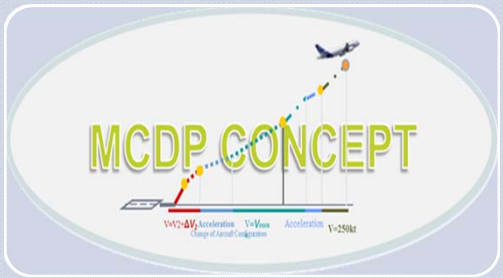


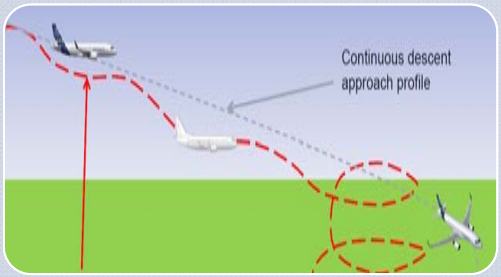
Quovadis study

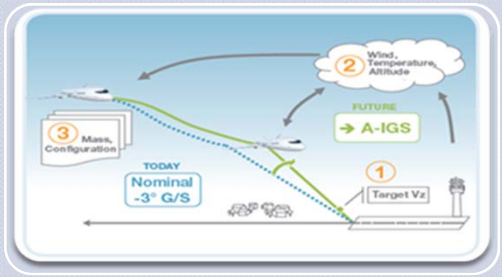
Optimised track for noise impact reduction

Next Steps for Operations Optimization

Future technology for lower noise







Departure

- Multicriteria optimization

Descent

- Energy management strategy
- Optimized Curved approaches

Final Approach

- Increased Glide Slope
- Adaptive Increased Glide Slope
- Steep segmented approach
- Displaced Threshold

Scope

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Conclusions

- Aircraft noise improvements have already been remarkable
- A/C Noise is not the only lever to work on – a balanced approach is needed
- A combination of technology & operations will see continued improvements: Manufacturers, ATC, operators and authorities together
- Airbus continues to invest in low-noise technologies

4.5 Boeing – Forschung und Entwicklung von leiserem und leistungsfähigem Fluggerät

4.5.1 Vortragender

Belur.N. Shivashankara Ph.D., Senior Technical Fellow, Boeing Commercial Airplane Co.

Dr. Belur Shivashankara is responsible for leading technology programs for developing environmentally progressive products and services across the Boeing Commercial Airplanes organization. He currently is leading the definition of a series of full scale flight tests with the objective of developing advanced technologies to improve fuel efficiency and reduce community noise of commercial airplanes. Dr. Shivashankara directed the Quiet Technology Demonstrator 2 (QTD 2) test program that validated key low-noise features for both 787 and 747-8 airplanes. He has also led collaborative programs to evaluate and validate flight operational procedures to lower noise and reduce fuel consumption.

Further Information about the company:
Boeing is the world's leading aerospace company and the largest manufacturer of commercial jetliners and military aircraft combined. Additionally, Boeing designs and manufactures rotorcraft, electronic and defense systems, missiles, satellites, launch vehicles and advanced information and communication systems. As a major service provider to NASA, Boeing is the prime contractor for the International Space Station. The company also provides numerous military and commercial airline support services. Boeing provides products and support services to customers in 150 countries and is one of the largest U.S. exporters in terms of sales.
Boeing has a long tradition of aerospace leadership and innovation. We continue to expand our product line and services to meet emerging customer needs. Our broad range of capabilities includes creating new, more efficient members of our commercial airplane family; integrating military platforms, defense systems and the warfighter through network-centric operations; creating advanced technology solutions that reach across business units; e-enabling airplanes and providing connectivity on moving platforms; and arranging financing solutions for our customers.
Headquartered in Chicago, Boeing employs more than 170,000 people across the United States and in 70 countries. This represents one of the most diverse, talented and innovative workforces anywhere. More than 140,000 of our people hold college degrees--including nearly 35,000 advanced degrees--in virtually every business and technical field from approximately 2,700 colleges and universities worldwide. Our enterprise also leverages the talents of hundreds of thousands more skilled people working for Boeing suppliers worldwide.

4.5.2 Präsentation

Link zum Mitschnitt der Präsentation:
Deutsch: http://www.youtube.com/watch?v=-owHuC3zdBs&feature=youtu.be
English: http://www.youtube.com/watch?v=hg1ny0hJ08E&feature=youtu.be

Commercial Airplanes
Engineering

Boeing Noise Research and Development for Quieter and Efficient Aircraft

Belur N. Shivashankara Ph. D.
Senior Technical Fellow
Boeing Commercial Airplanes
October 30, 2013

Each Airplane Quieter and More Efficient

Technology is the key

- **50% smaller noise footprint**
- 27% lower CO_2 per seat

- **60% smaller noise footprint**
- 20% lower CO_2 per seat

- **30% smaller noise footprint**
- 16% lower CO_2 per seat

737NG – Continuous Innovation

Improves environmental performance

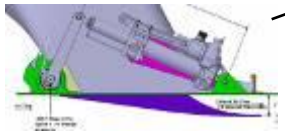
2000 180 min ETOPS for more direct flights

2011 wing control surfaces refined to reduce drag

2011 light fairing reduces drag

2000 thrust automation reduces community noise

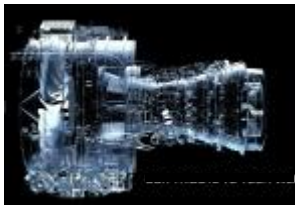
2001 Blended winglets reduce fuel and noise



2011 Air inlet / exhaust reduces drag

2007 Carbon brakes reduces weight

2011 Wheel well fairing reduces drag

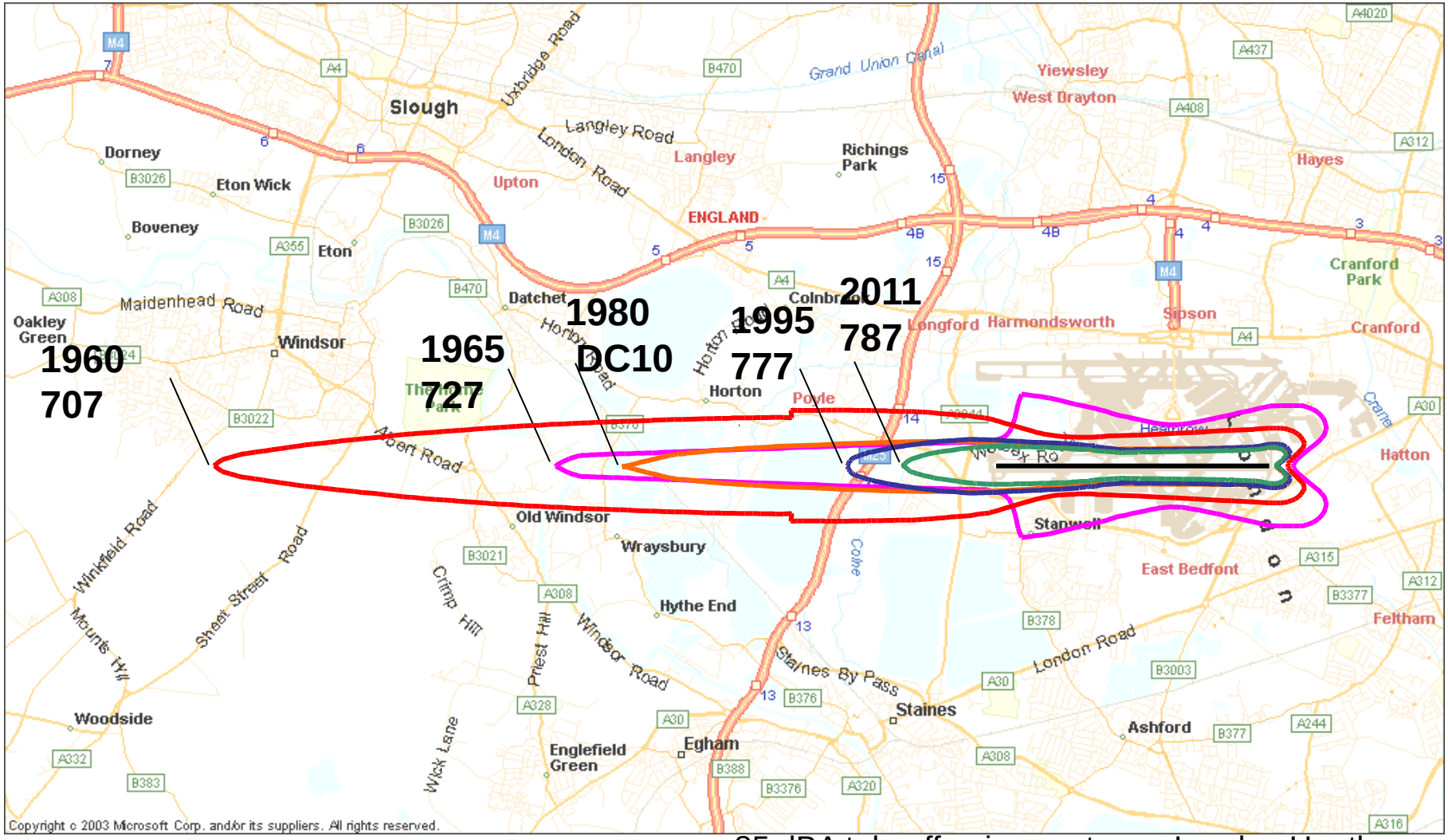


Engine improvements
2007 NOx reductions
2011 lower fuel use

Continual reduction in emissions and noise – from introduction to today

Historical Noise Footprint Reduction

Community noise reduction has been significant over the years



85 dBA takeoff noise contours, London Heathrow

Technologies For Quieter Airplanes

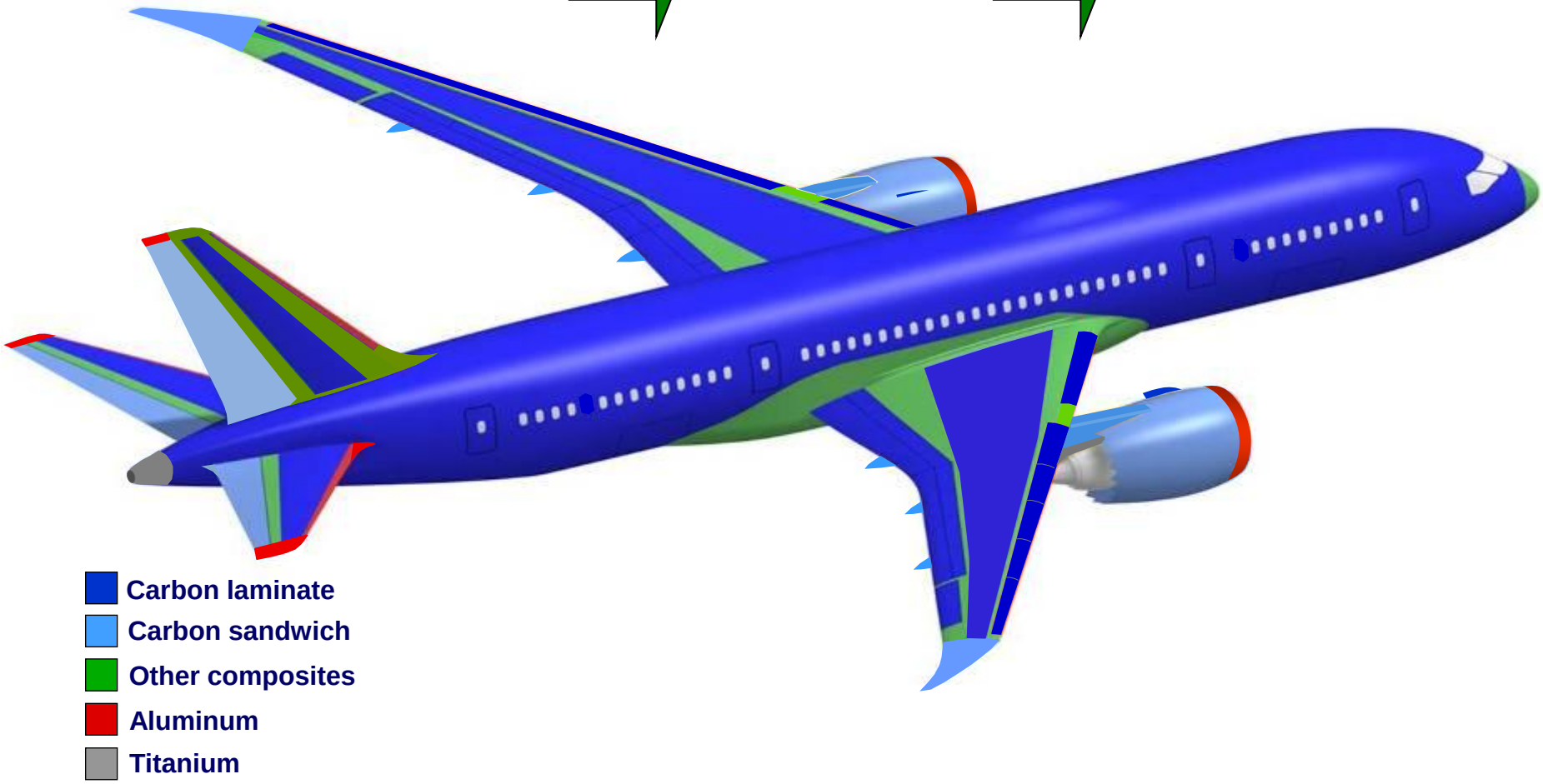
Design for efficiency and lower noise

Quiet flight operational procedures

Source noise reduction

Use of Composites on 787 Lowers Noise

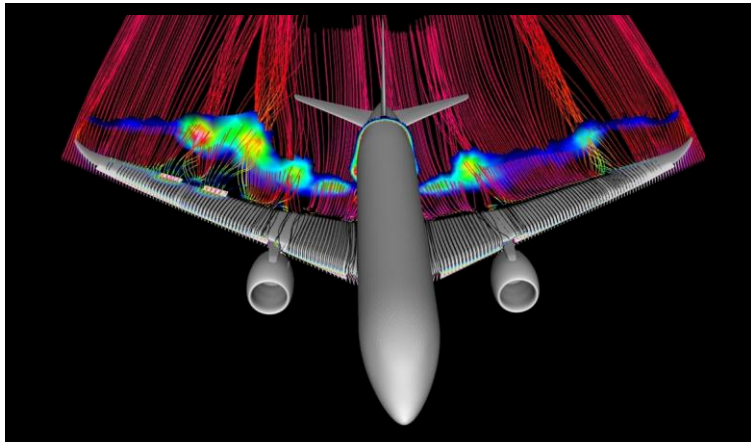
Lighter → **Less Thrust** → **Less Noise**

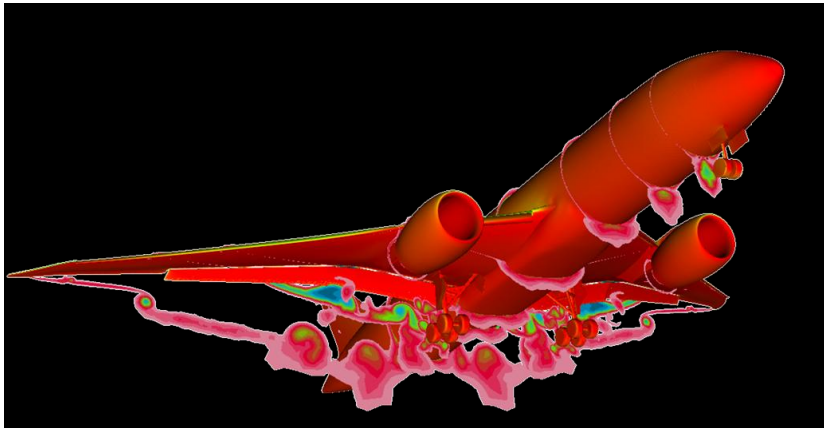


Advanced Aerodynamics

Quieter and efficient

Lower drag → **Lower fuel** → **Lighter airplane** → **Less Noise**

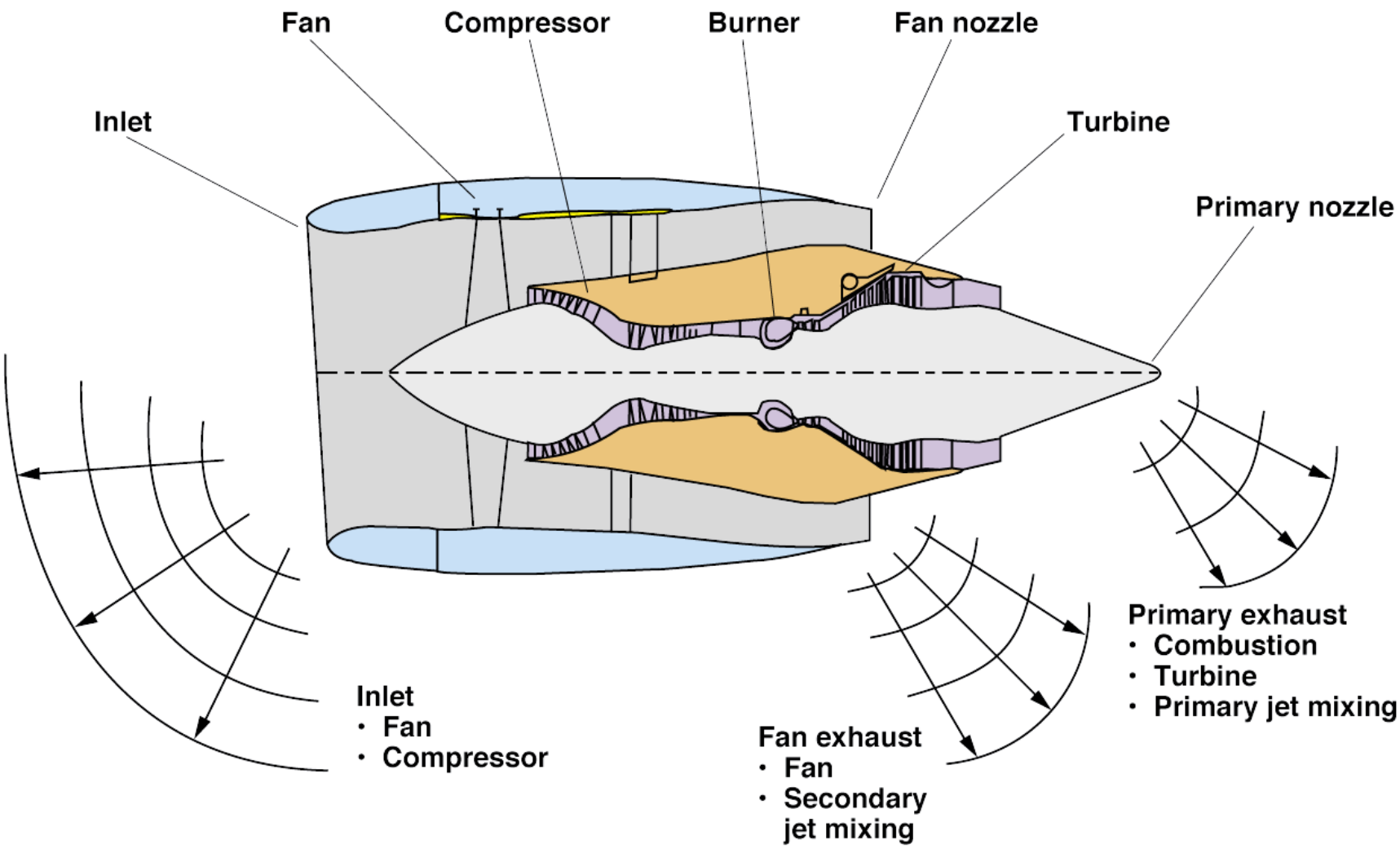




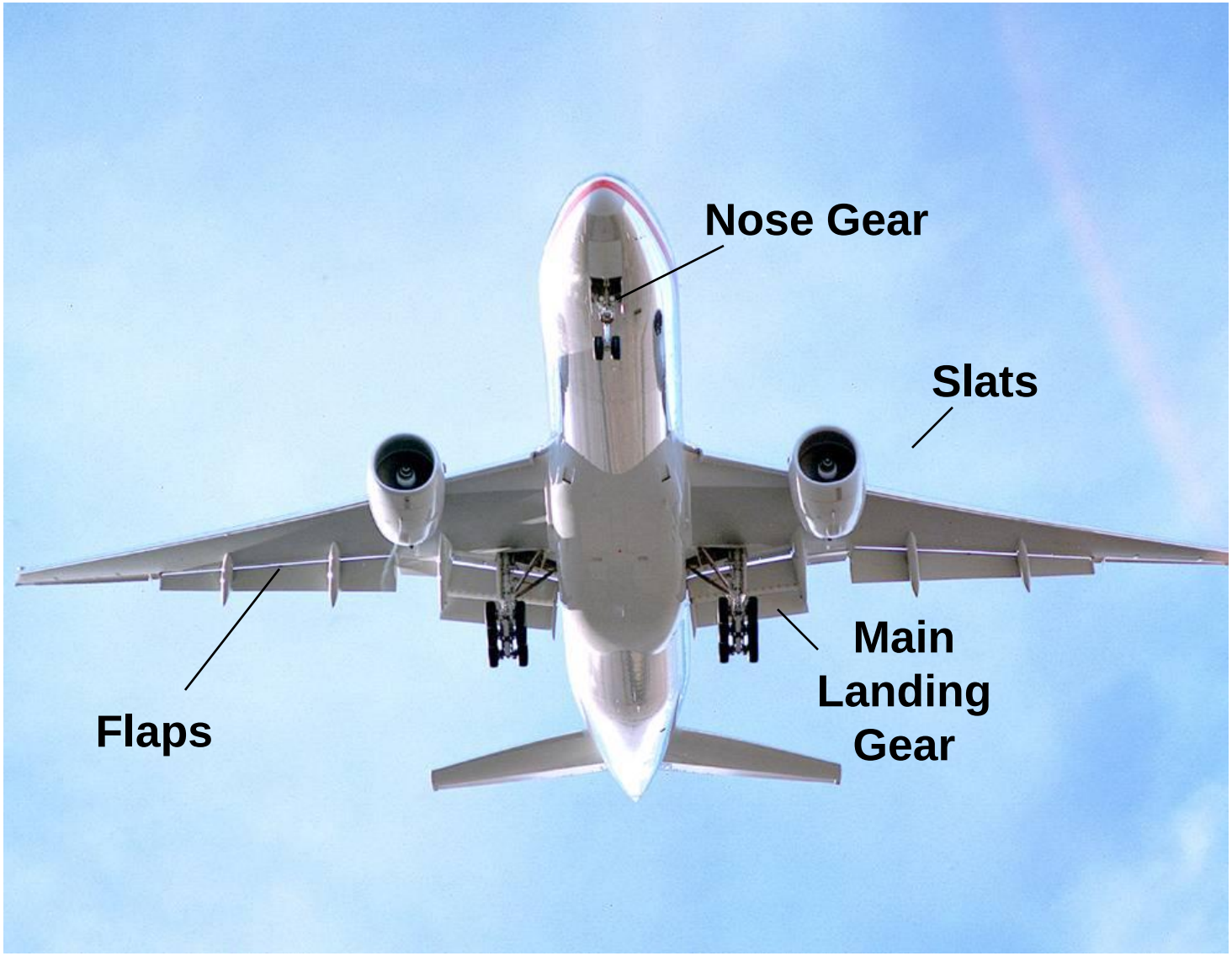
New Engines are Quieter and Efficient

- Higher bypass ratio
- No-engine-bleed systems architecture (787)
- Low-noise nacelles with chevrons
- Laminar flow nacelles

High Bypass Ratio Engine Noise Sources



Airframe Noise Sources



Modern High Lift Devices

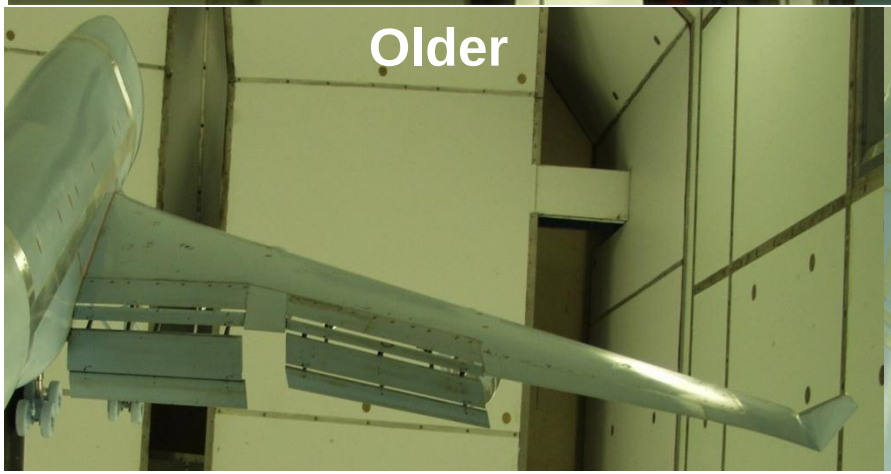
Quieter, effective and simpler

747-400

747-8

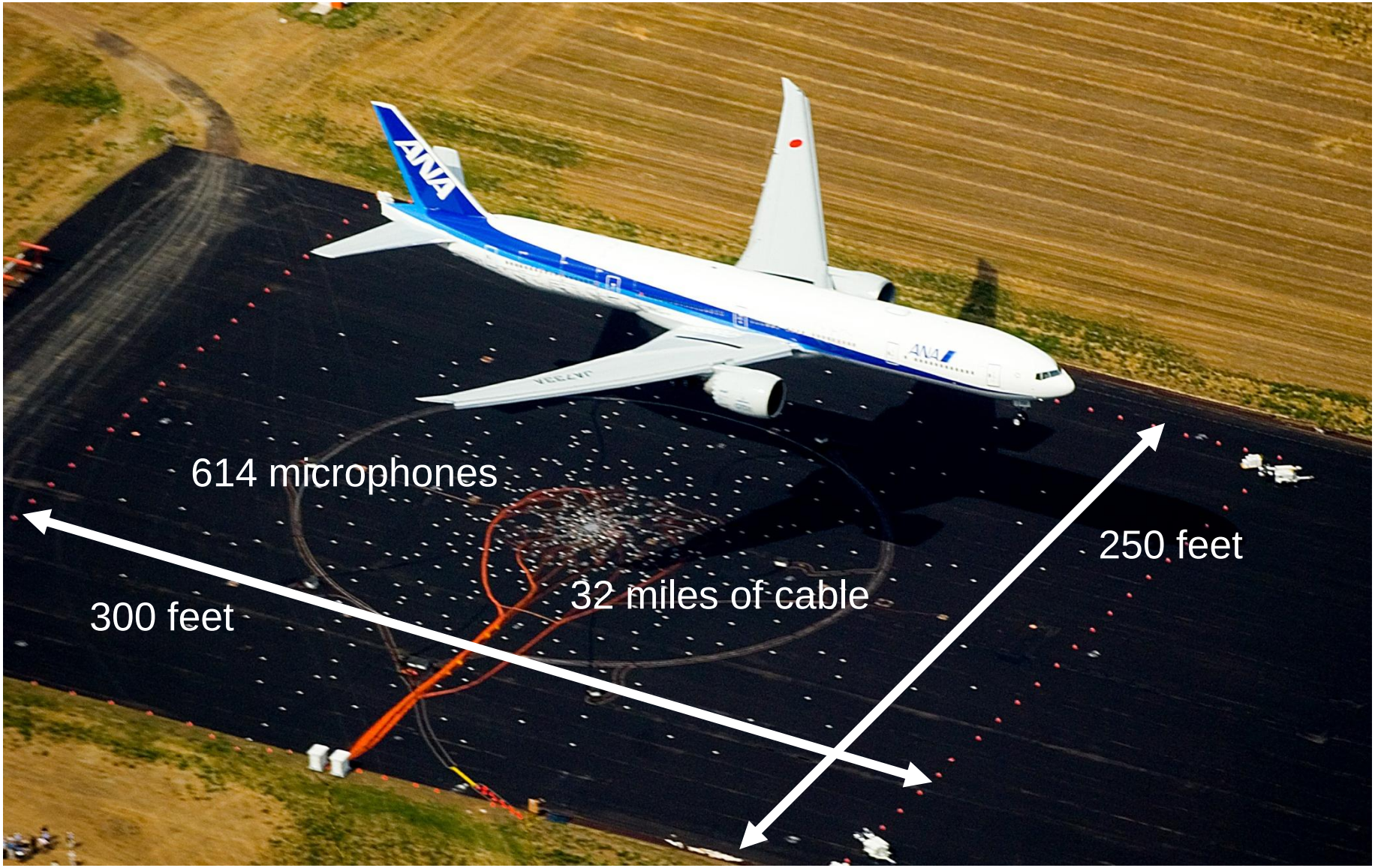
Extensive Test Programs and Attention to Details

- Wind-tunnel testing
- Engine testing
- Flight testing

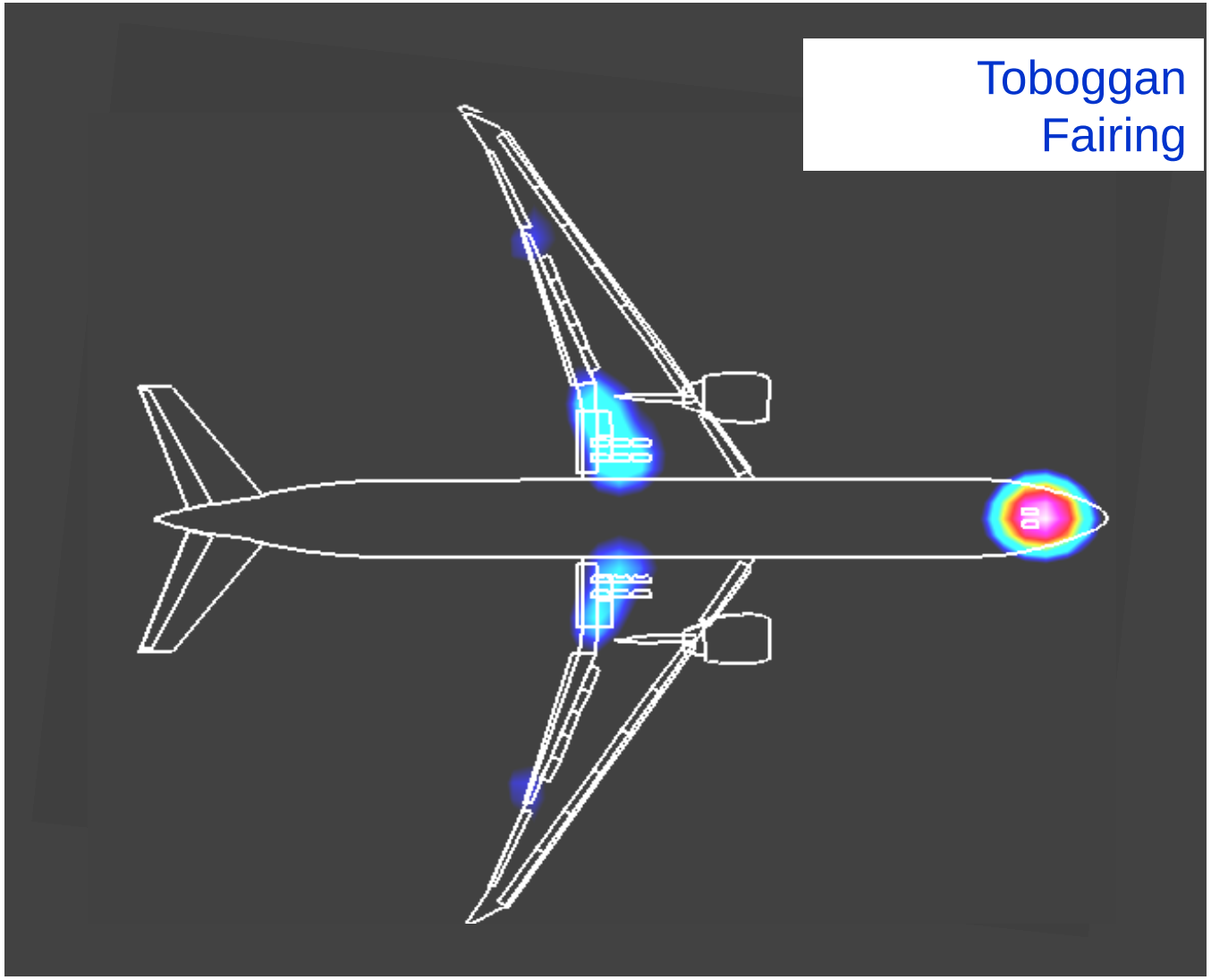


Toboggan Landing Gear Fairing

Phased Array Microphones

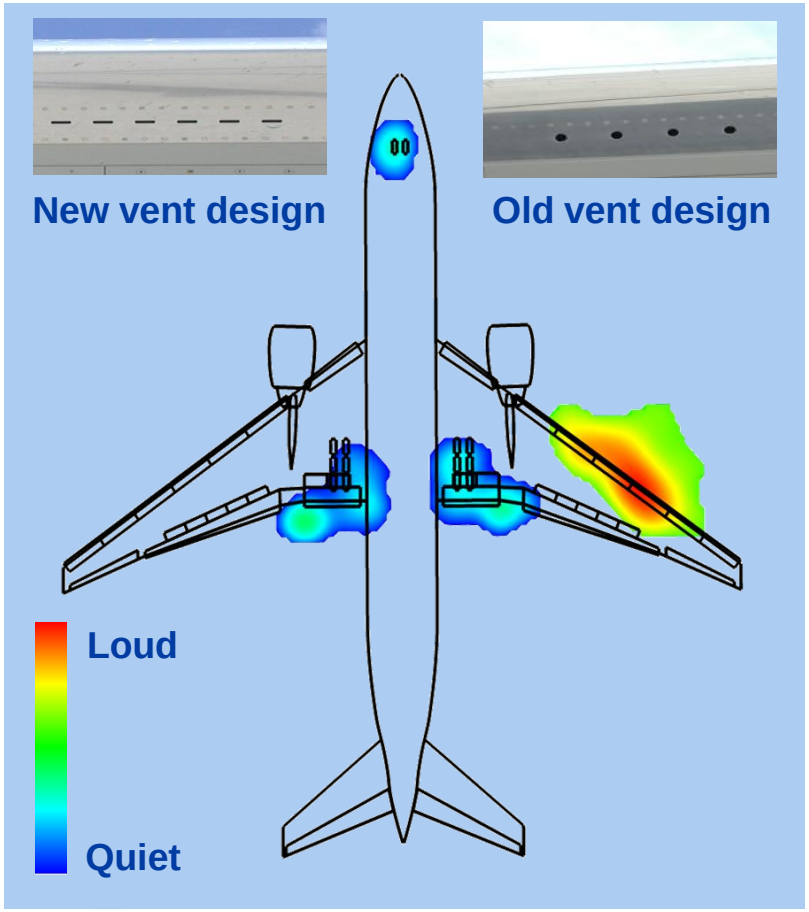


Toboggan Landing Gear Shows Promise



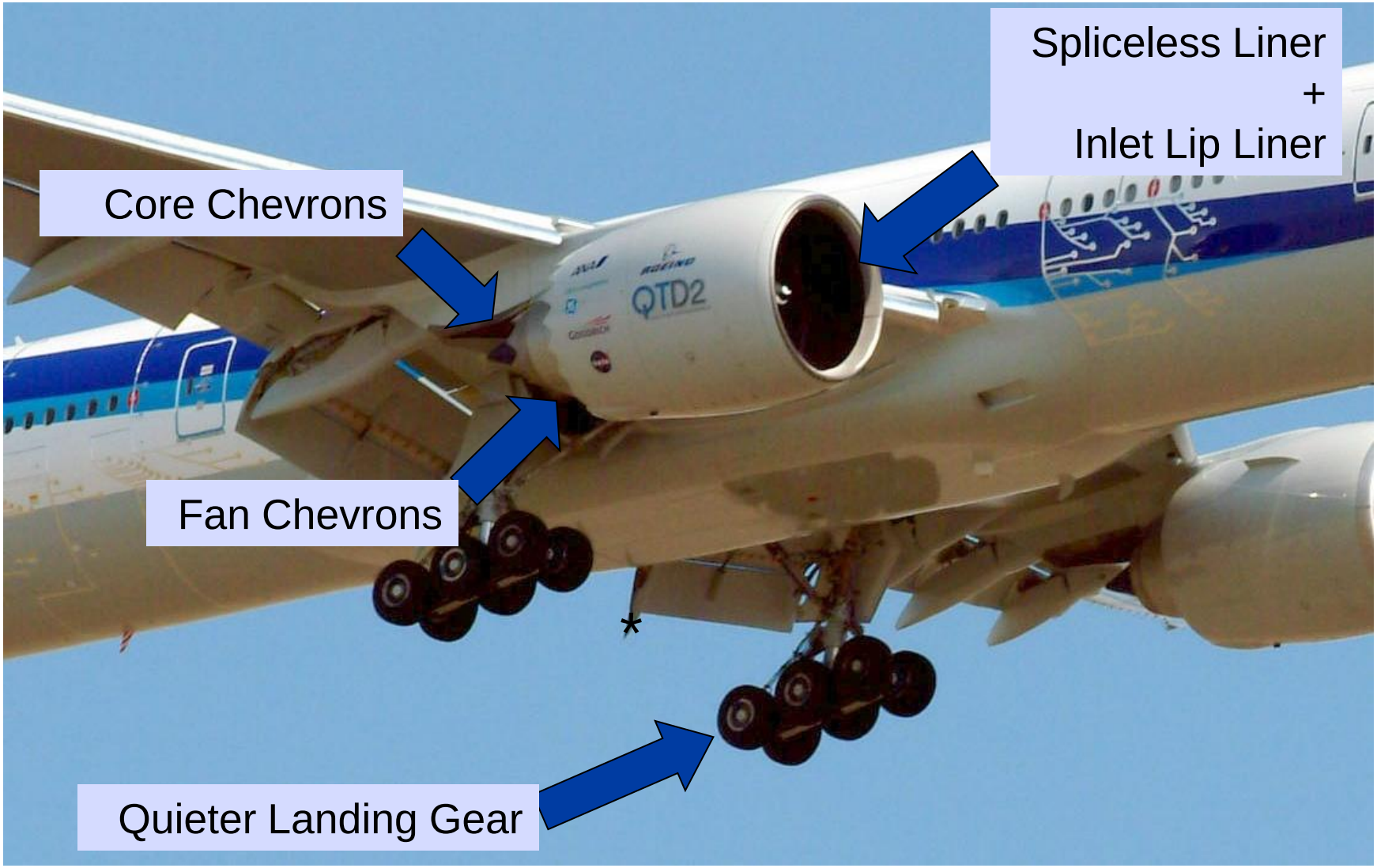
800Hz

777 Quiet Wing Vent Feature



Quiet Technology Demonstrator QTD2

Noise reduction technologies



Chevrons

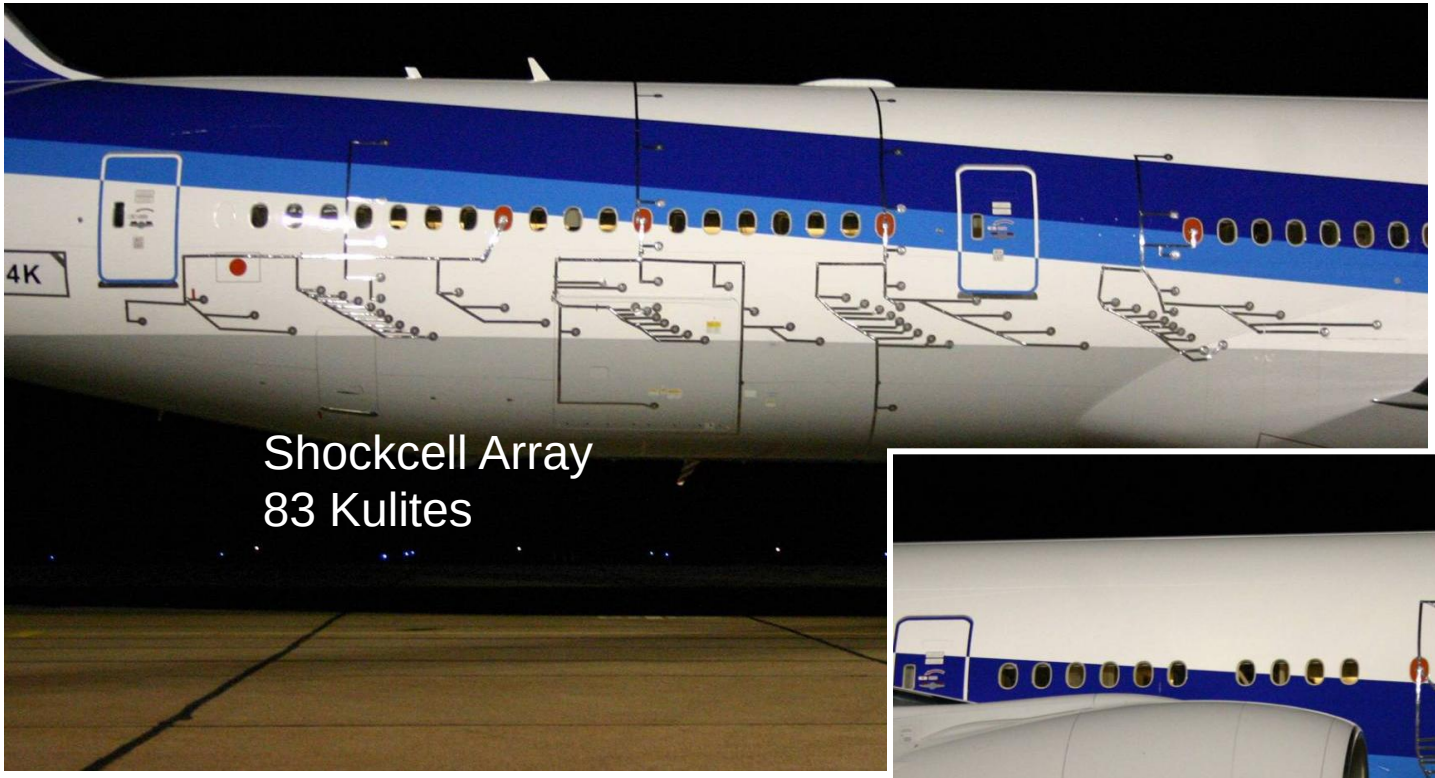
Acoustic Liner in Engine Inlet

Baseline Inlet

QTD2 Inlet:

- Axial splices eliminated
- Treatment extended fore and aft
- 40% increase in treated area

Extensive Noise Data Helps Develop Solutions

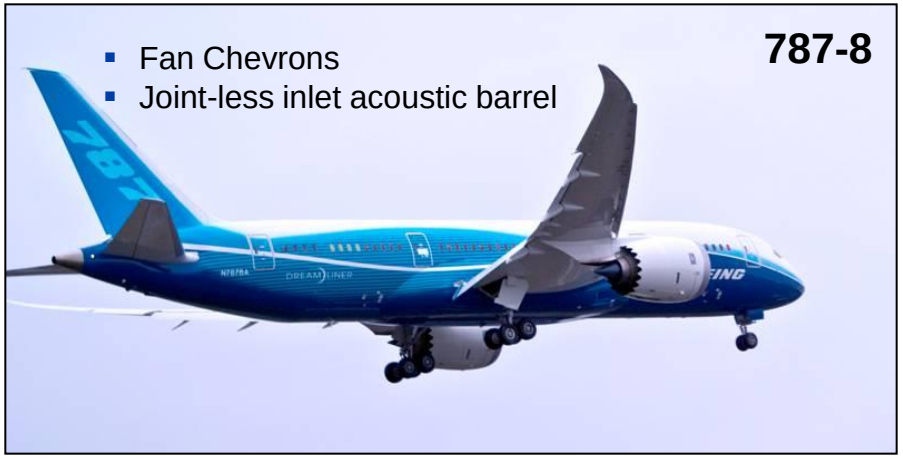


Shockcell Array
83 Kulites

Buzzsaw Array
42 Kulites

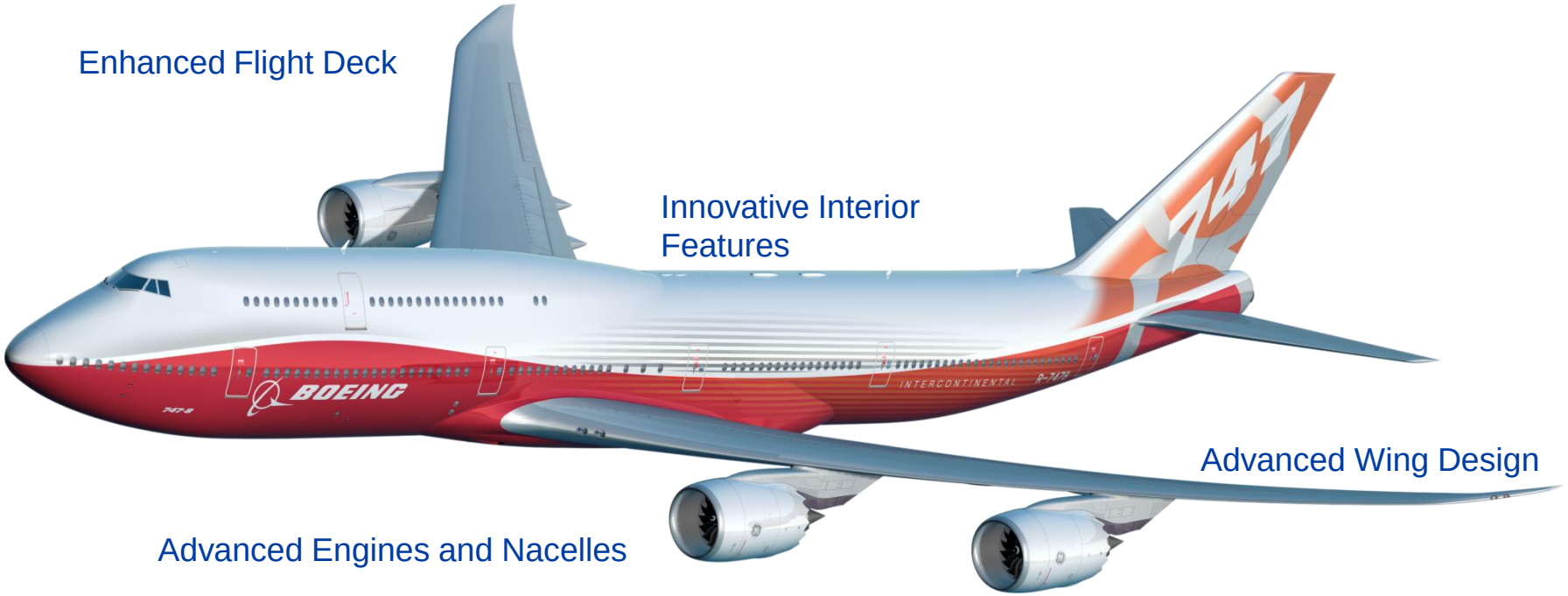
Quiet Technologies Implemented

Technology Demonstrator Programs are Key to increasing TRL and implementing technology



Benefits validated during noise certification tests

747-8



Cleaner, quieter and more efficient

16%* Reduction in fuel and CO2

30%* Smaller noise footprint

*Relative to the 747-400

Accelerate Technology
ecoDemonstrator Program

Goals

- Accelerate technology for more fuel efficient, cleaner, quieter, advanced materials
- Faster innovation to application-ready technologies
- Work together - industry, suppliers and government
- Learn prior to critical path
- Design, build, integrate, fly (annually)
- Inspire people to innovative thinking and solutions

Federal Aviation Administration
Continuous Lower Energy and Emissions and Noise
FAA CLEEN

Potential collaborations

2012	2013	2014	2015	2016	2017	20XX

Advanced aerodynamics

Optimized integration

Hybrid power

Charting the course to a sustainable future

2012 ecoDemonstrator 737-800

Adaptive Trailing Edges
(FAA CLEEN)

Flight Trajectory Optimization and onboard networking systems

Vertical Navigation Performance containment

Variable Area Fan Nozzle

RFID Demo

Low Noise Approach

Phased Array Nose Gear Noise

Insulated Galley Cart

Recyclable Carpet Tiles

Battery Temp Monitoring

Active Engine Vibration Reduction

Regenerative Fuel Cell with IHI

Legend
Fuel Burn
Noise Reduction
Operational Efficiency
Sustainable Materials

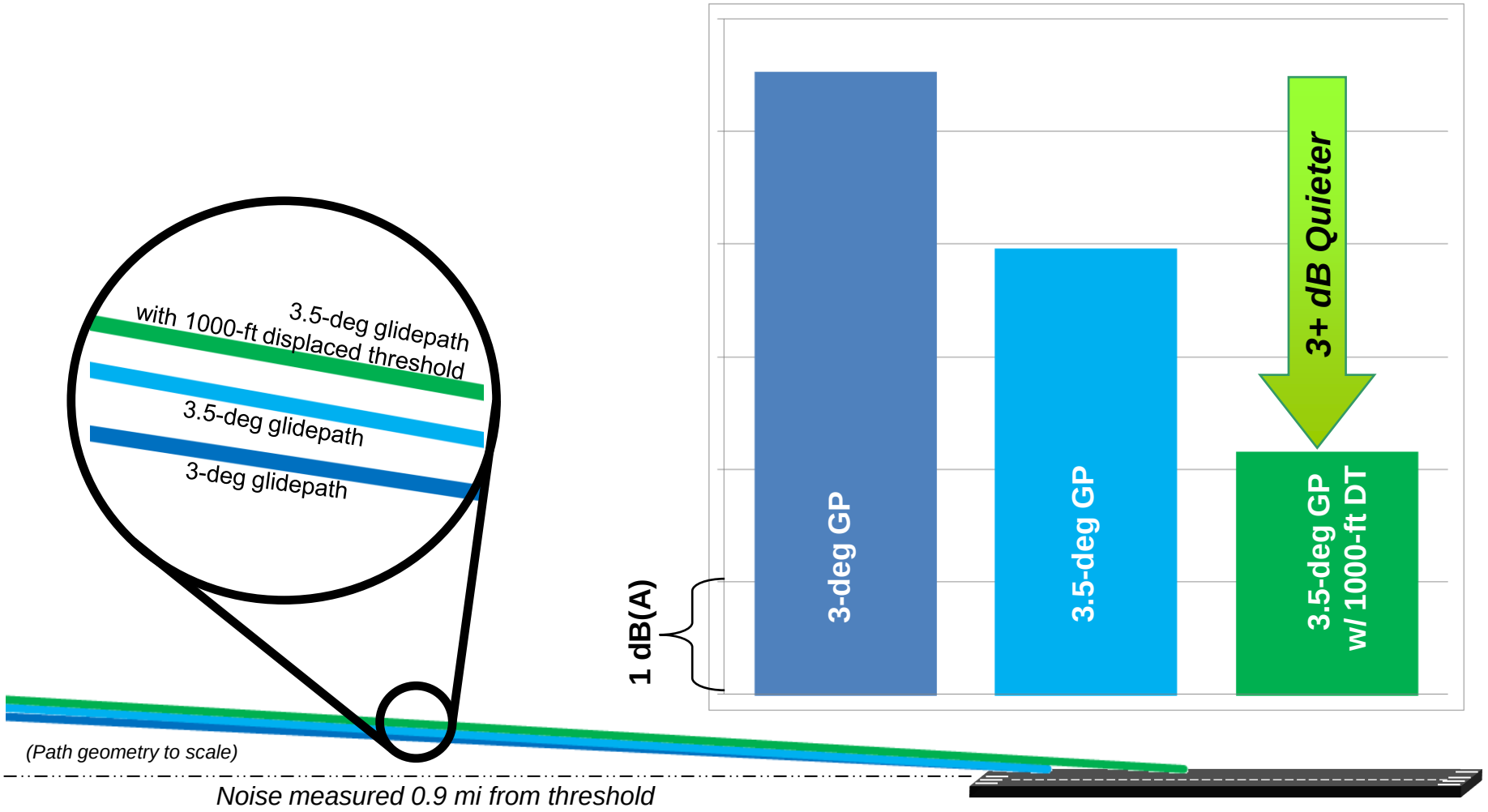
Variable Area Fan Nozzle Reduces Noise

Variable Area Fan Nozzle - Extended

Adaptive Trailing Edge Reduces Noise

Slightly Increased Glide Slope Test Results

Measured noise data showed good agreement with predictions



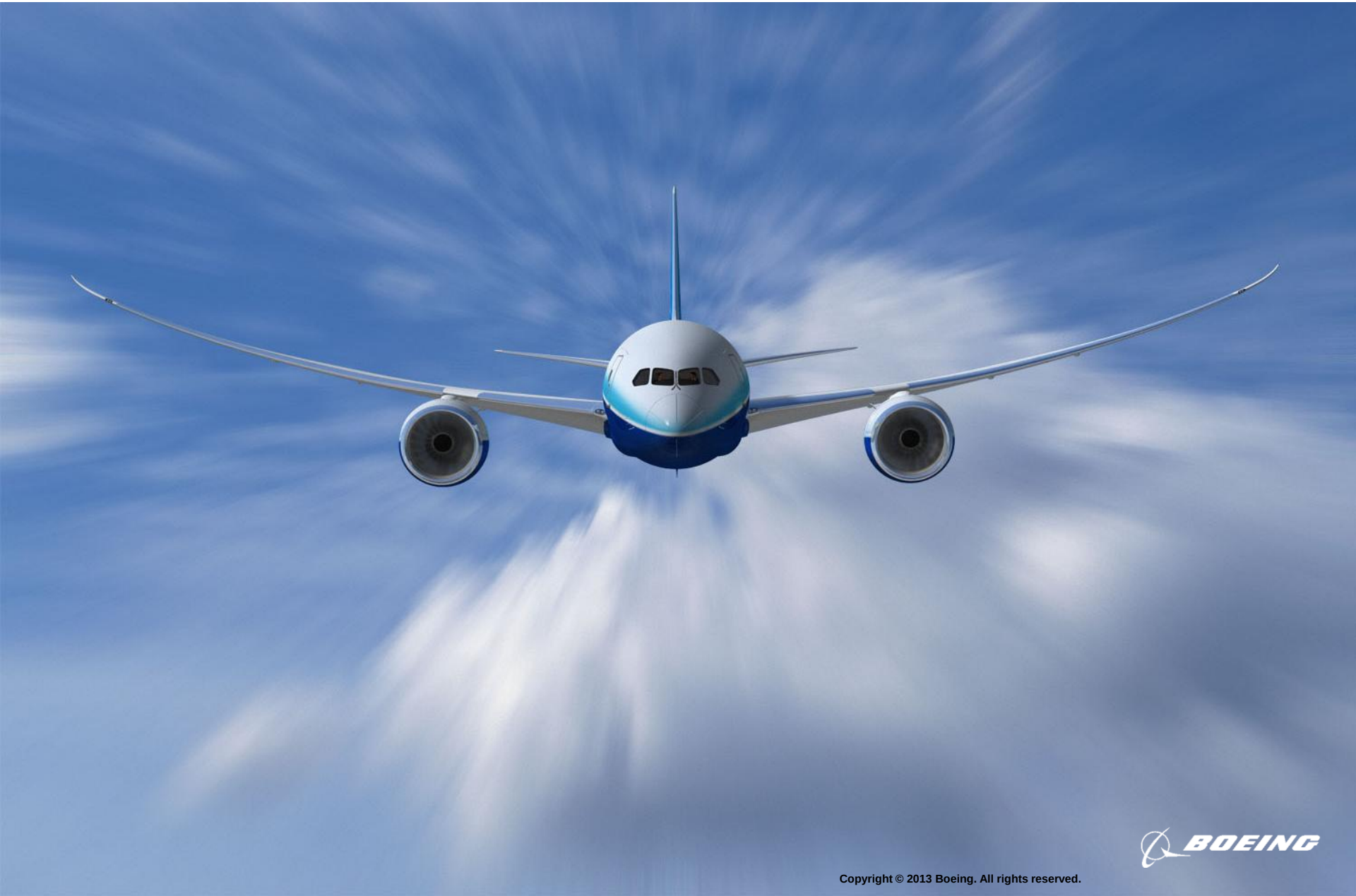
Small approach geometry changes yield large noise reductions

Summary

Noise Research and Development for Quieter and Efficient Aircraft

- Technical innovation has been the key to community noise reduction
- Quieter technologies are often incorporated as product improvements
- Large full scale flight test programs have been conducted to accelerate implementation of quieter technologies on to our airplanes
- Several new noise reduction technologies are being validated in the ecoDemonstrator program flight tests

Thank You!



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Author(s):	Belur N Shivashankara

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Candice Jordan
Contracts Specialist
Intellectual Property Management

4.6 Aktiver Schallschutz im Triebwerksbau

4.6.1 Vortragender

Fredi. Holste, Chief Acoustics, Rolls-Royce Deutschland Ltd. & Co.KG

Herr Holste ist am 28. September 1956 in Klein Bennebeck geboren. Nach seinem Abitur studierte er von 1979 – 1986 Technischen Umweltschutz an der TU-Berlin mit dem Schwerpunkt Akustik und Schwingungstechnik. Er promovierte 1995 zum Doktor der Ingenieurwissenschaften an der TU – Berlin (Thema: "Ermittlung der aerodynamischen Lärmquellen und Berechnung des abgestrahlten Schallfeldes mittels der im Nahfeld gemessenen Druckschwankungen am Beispiel eines Triebwerksmodells". Beruflich war er 1986 Wissenschaftlicher Mitarbeiter am Institut für Verkehrsplanung und Verkehrswegebau, Technische Universität Berlin, 1987 Wissenschaftlicher Mitarbeiter bei der Deutschen Forschungsanstalt für Luft- und Raumfahrt (DLR), Abteilung Turbulenzforschung, inzwischen umbenannt zu Triebwerksakustik, Berlin. Von 1996 an ist er Entwicklungsingenieur bei Rolls-Royce Deutschland, seit 2002 Leiter der Akustik Gruppe bei RRD und seit 2013 RR Engineering Associate Fellow – Noise & Acoustic Technology.

4.6.2 Präsentation

Link zum Mitschnitt der Präsentation:

Deutsch: http://www.youtube.com/watch?v=1W-PvJi4tJg&feature=youtu.be

English: http://www.youtube.com/watch?v=I-ke9kCD95Q&feature=youtu.be

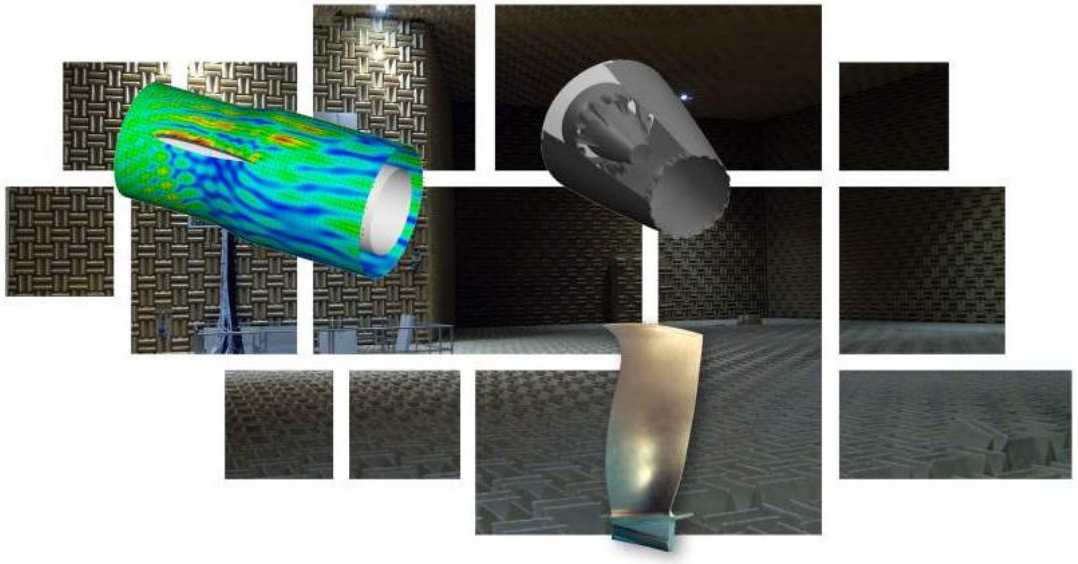
Noise Reduction Technologies at Aircraft Engines

2nd International Conference on Active Noise Abatement

October 30th – 31th , 2013

Frankfurt

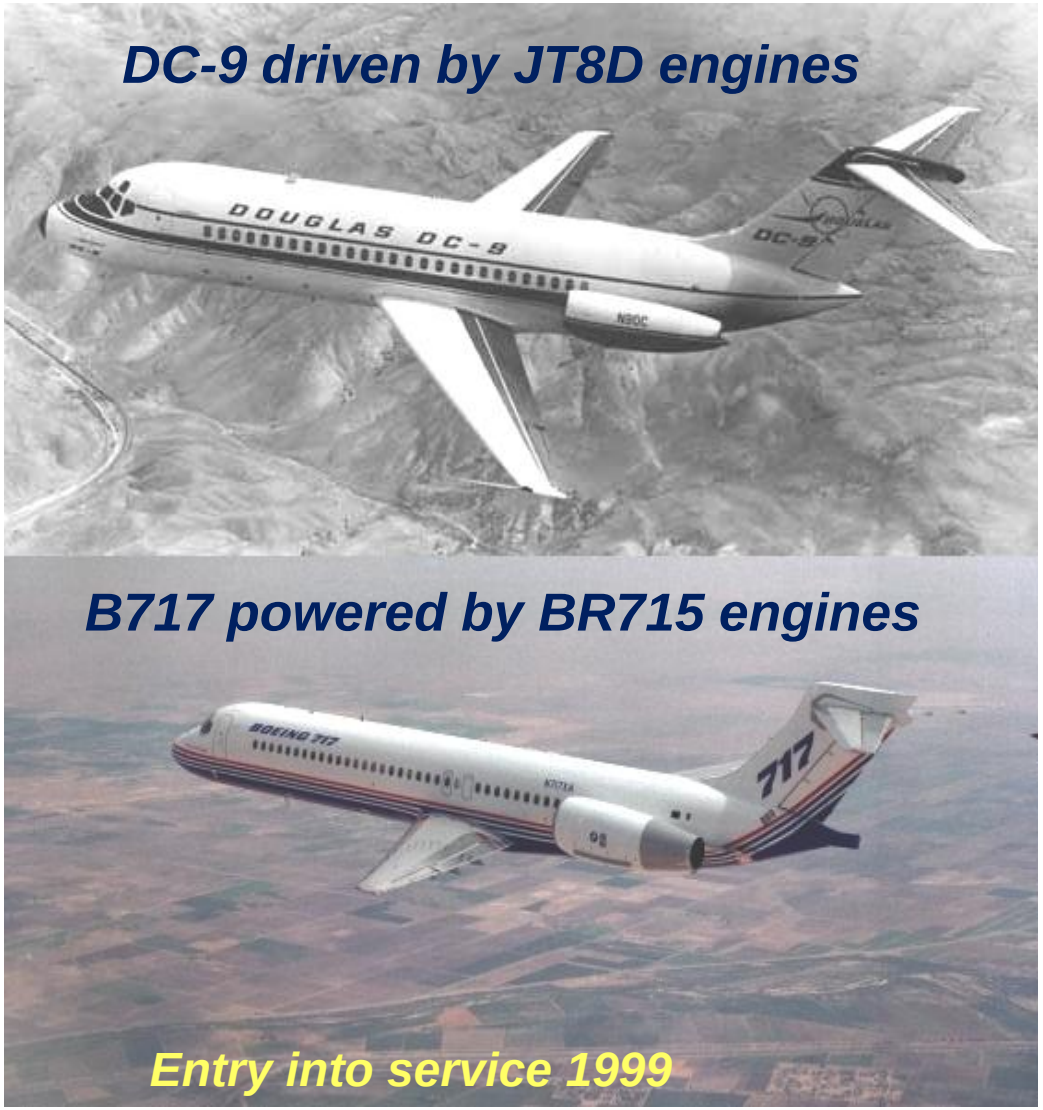
Dr. F. Holste
Rolls-Royce



Trusted to deliver excellence

Rolls-Royce

35 Years progress in aircraft engine development 1965 - 2000



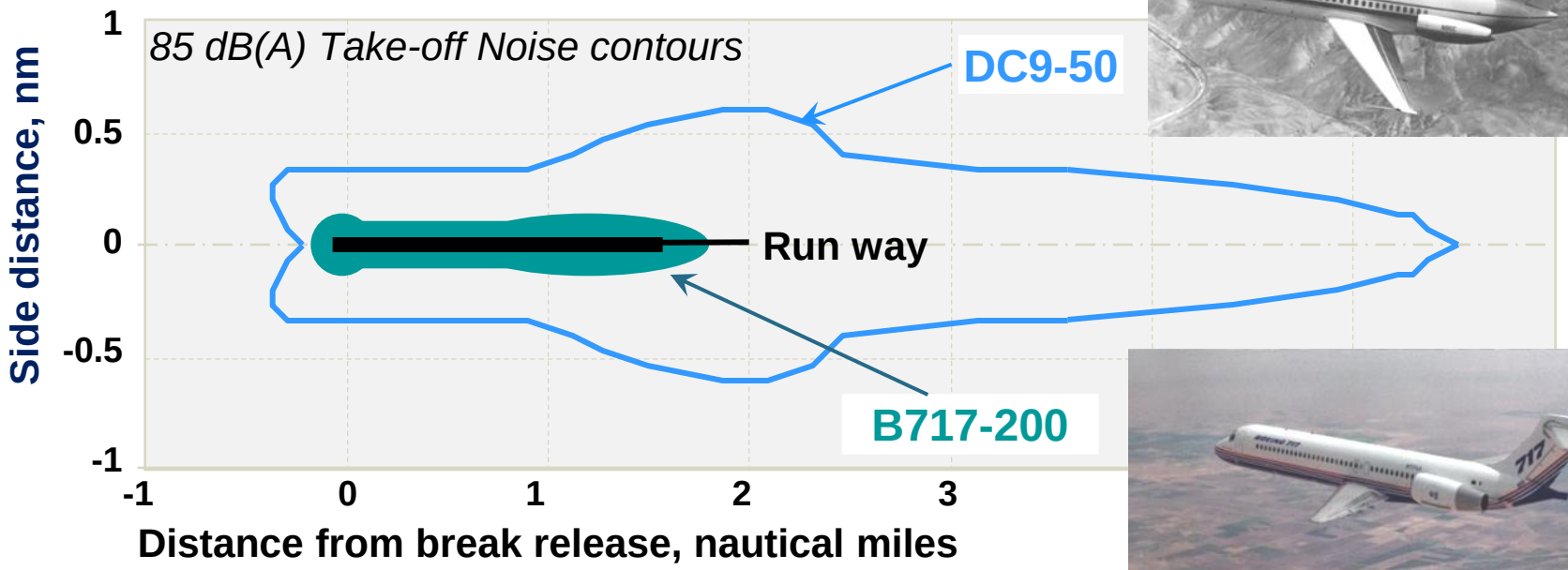
Example: 110 seat regional aircraft

- **Noise annoyance reduction by more than 75 %**

Rolls-Royce

Aircraft Noise: Historical Development

Reduction of foot print area down to 7,3 % (1965 – 2000)



DC9-50/JT 8D (EIS 1965)
Area = 87,9 km²

B717 / BR715 (EIS 2000)
Area = 6,4 km²

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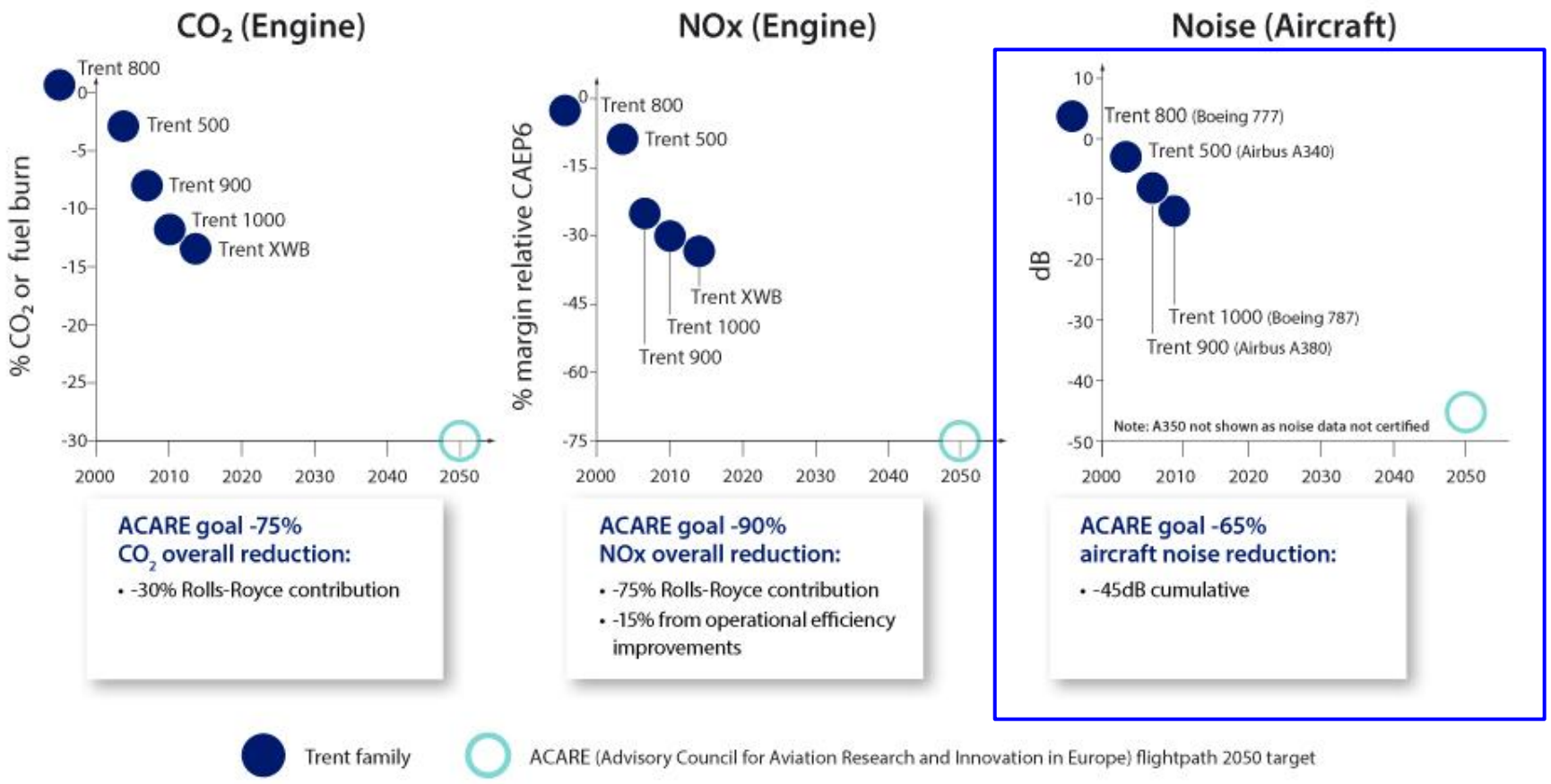
ACARE 2050 environmental goals



FlightPath 2050 Noise objective: 65 % annoyance reduction vs 2000

We are on the way, but major research - and development efforts are required to achieve the targets

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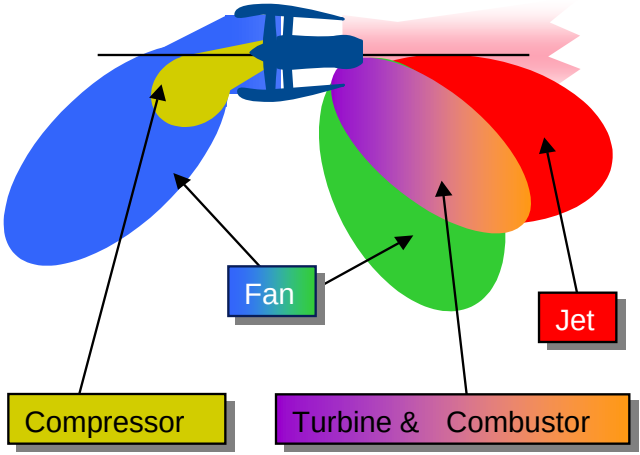
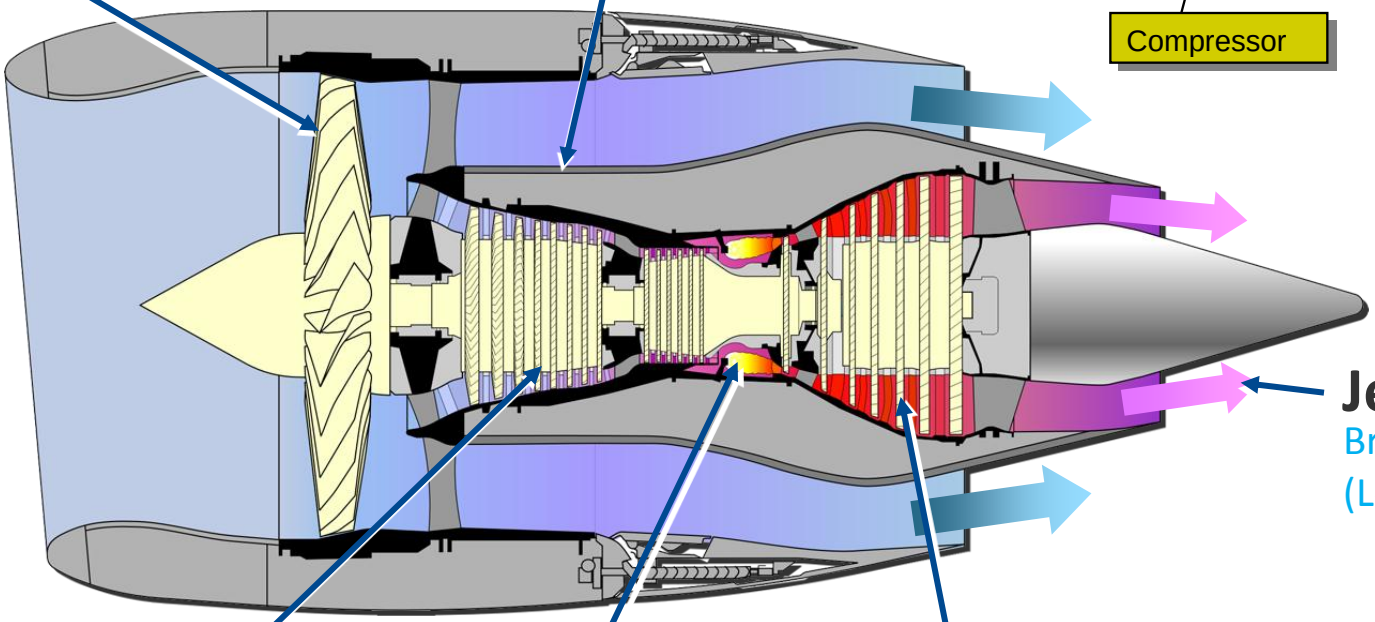
Sources of engine noise



Fan
Tones (All frequencies)
Broadband Noise
"Buzz-Saw" Noise

Offtakes
Broadband noise



Jet
Broadband Noise
(Low frequency)

Compressor
Tones (High frequency)

Combustor
Tones and Broadband (Low frequency)

TLP Turbine
Tones and broadband (High frequency)

All noise sources must be reduced

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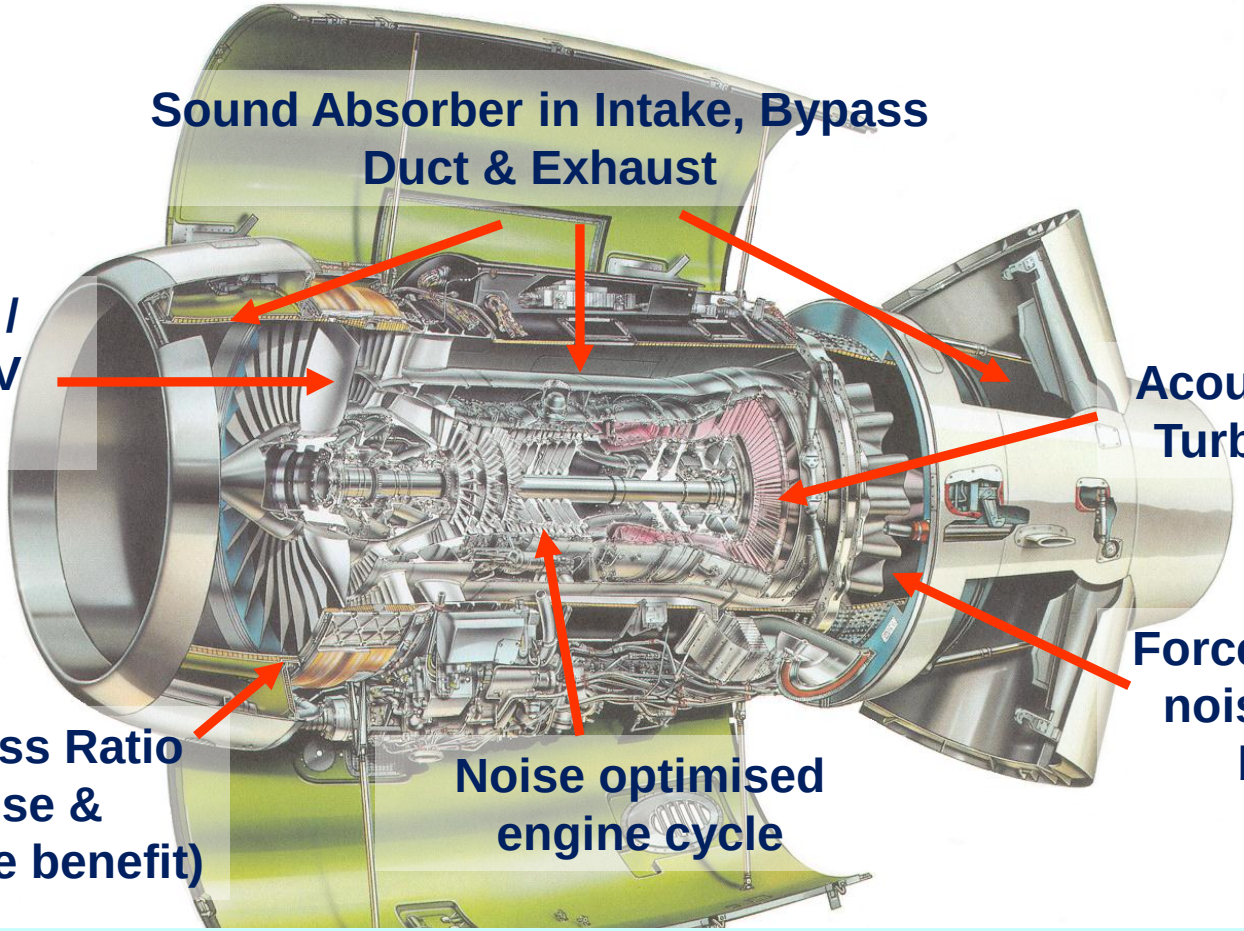
Low Noise Power Generation



Cycle and components designed and optimized for low noise and minimum environmental impact

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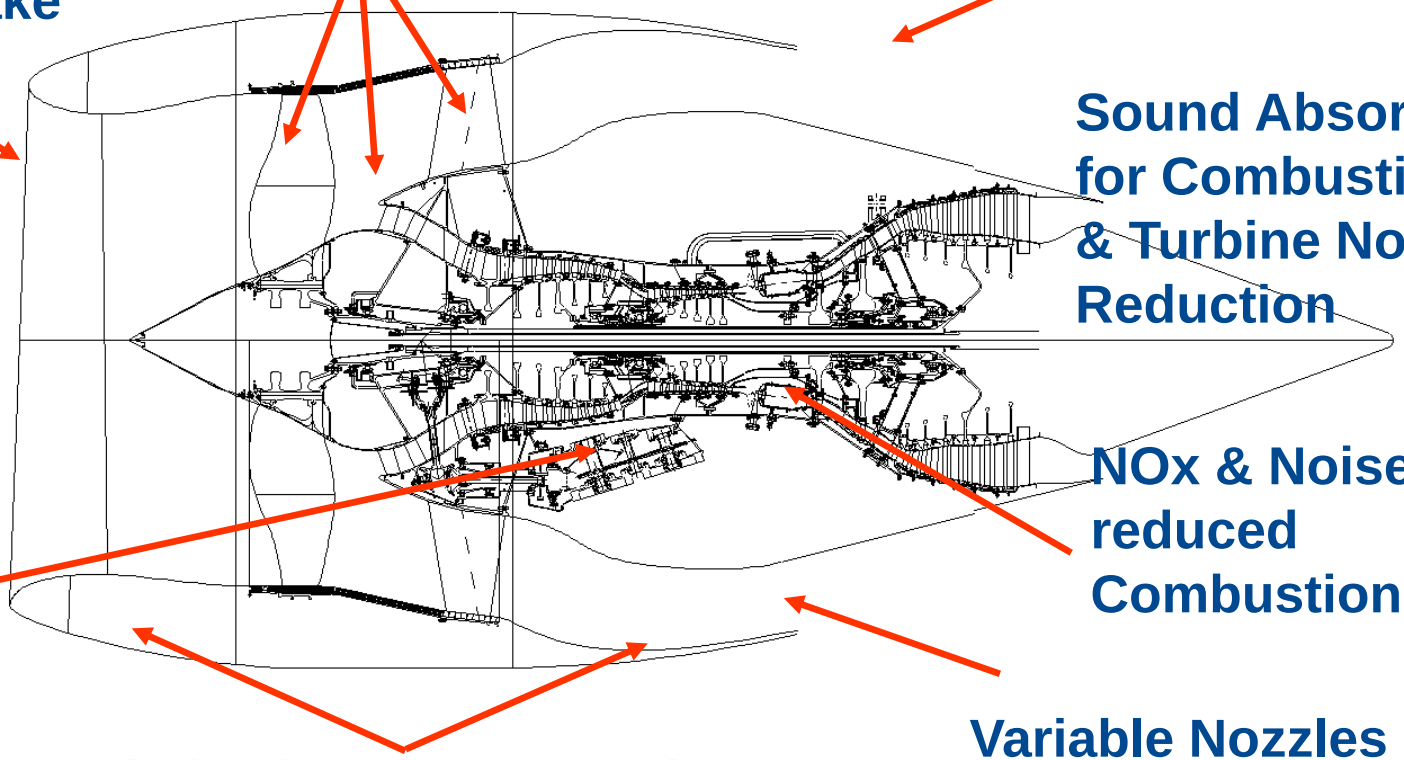
Near Term Noise Reduction Developments



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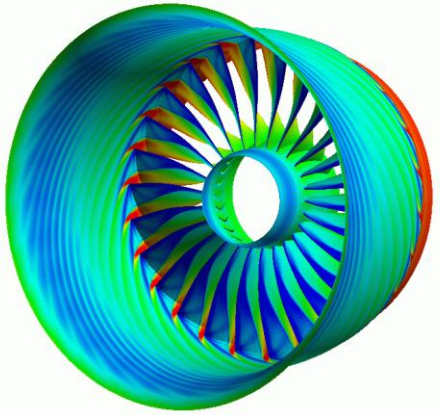
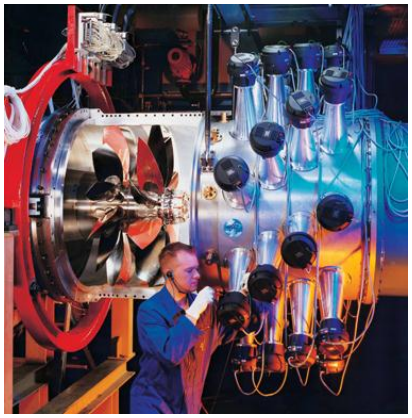
Enablers for further noise reduction developments

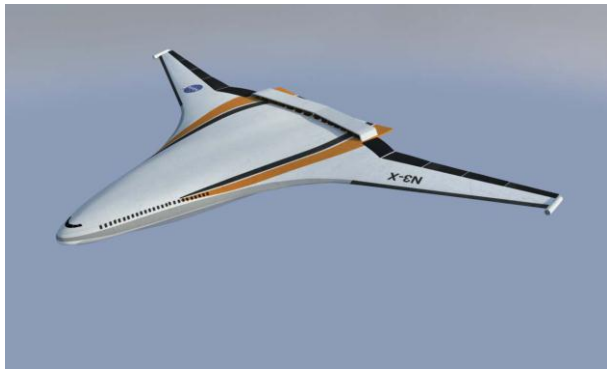
- Numerical Methods developments for low noise design of all engine components and aircraft
- Advanced acoustical absorber: wide band absorber, adaptive systems
- Active systems for fan-, turbine and jet noise reduction
- New power plant integrations to minimise the sound radiation to the ground



High-Power Computing



Active Reduction



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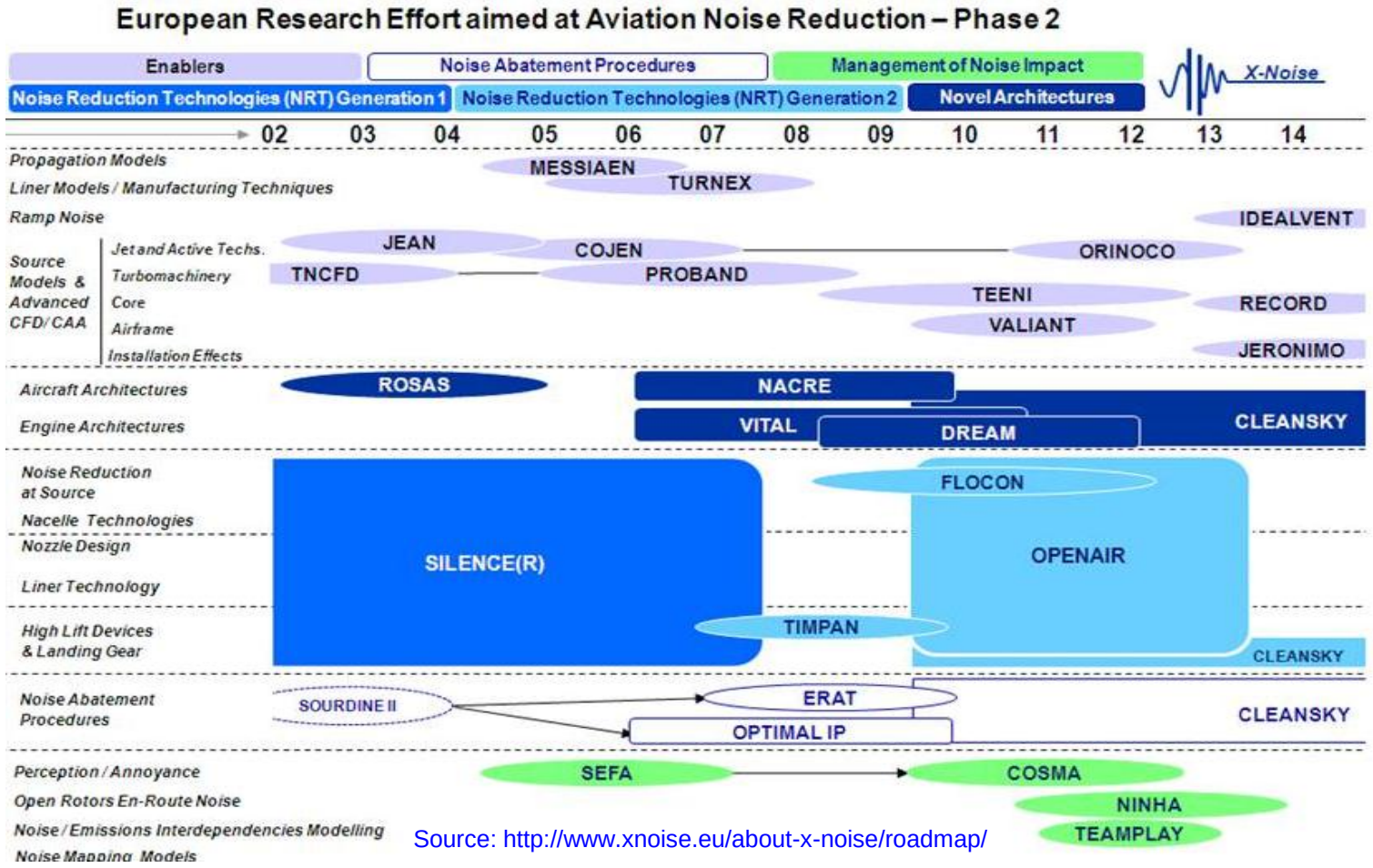
European noise research projects, X-Noise



Source: http://www.xnoise.eu/about-x-noise/roadmap/

Beside these European projects, several complementary national research project's on-going

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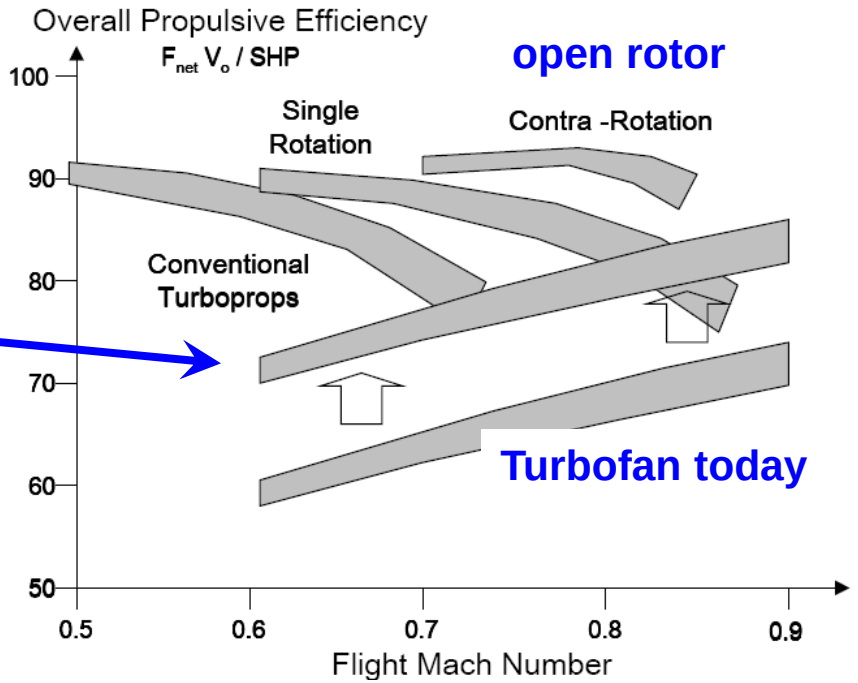
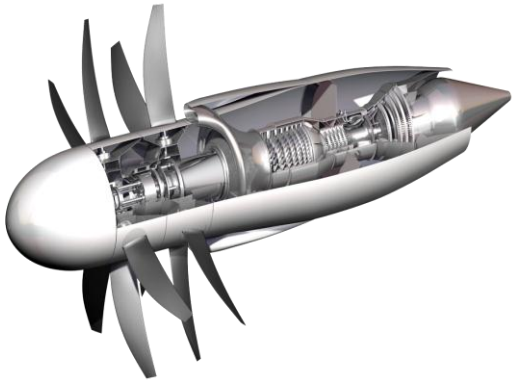
Open Rotor Technologie

- For Turbofans, the fuel consumption improvements are limited due to the increasing nacelle drag
- Therefore, open rotor technology promises 10 to 15 % additional fuel saving



Open Rotor



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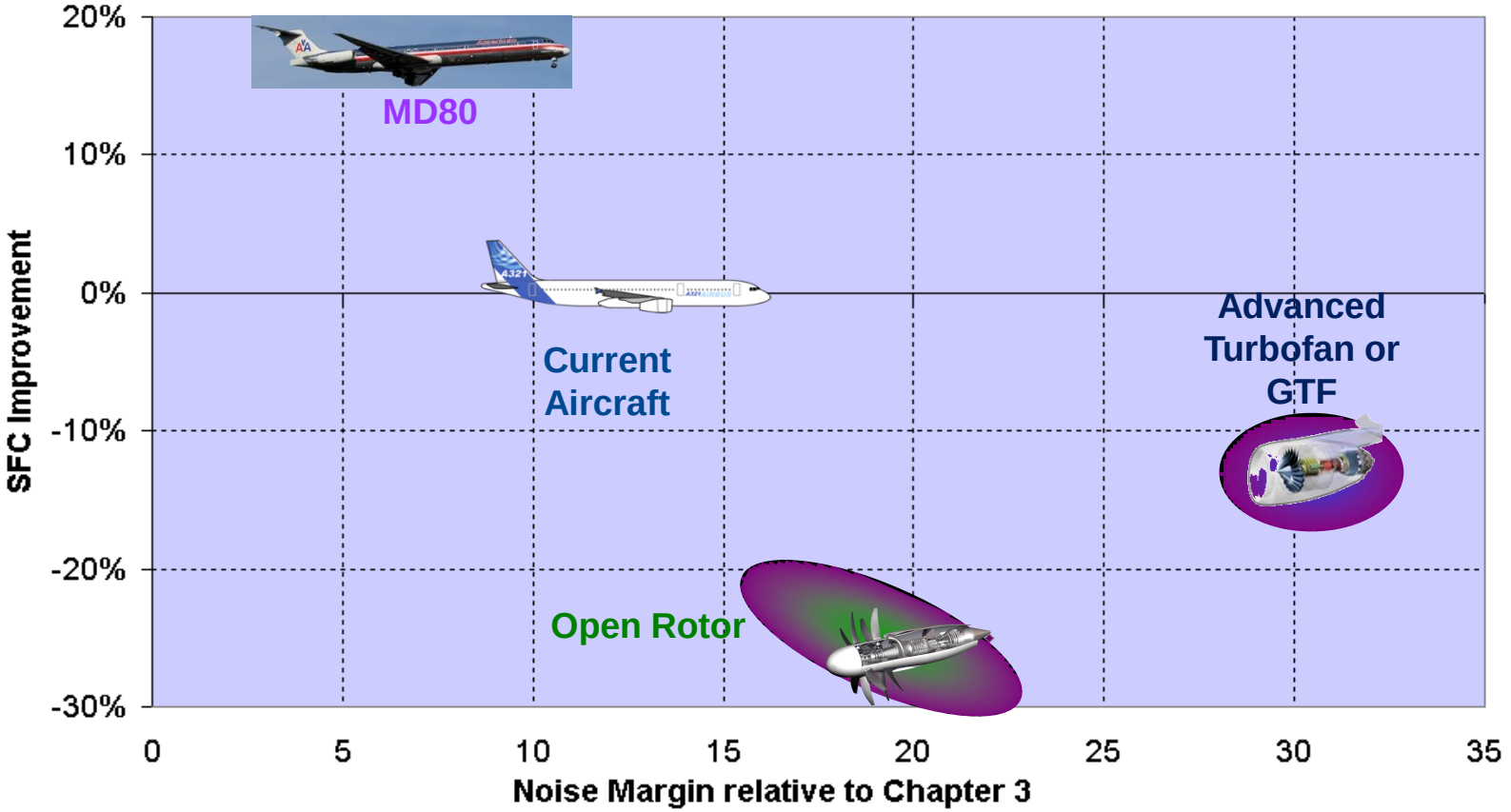
Open Rotor - Future decision required



- Noise optimised open rotor concepts achieve lower noise levels compared to current aircrafts, but less quiet compared to future turbofans
- Low noise versus additional fuel consumption, CO2 & NOx reduction

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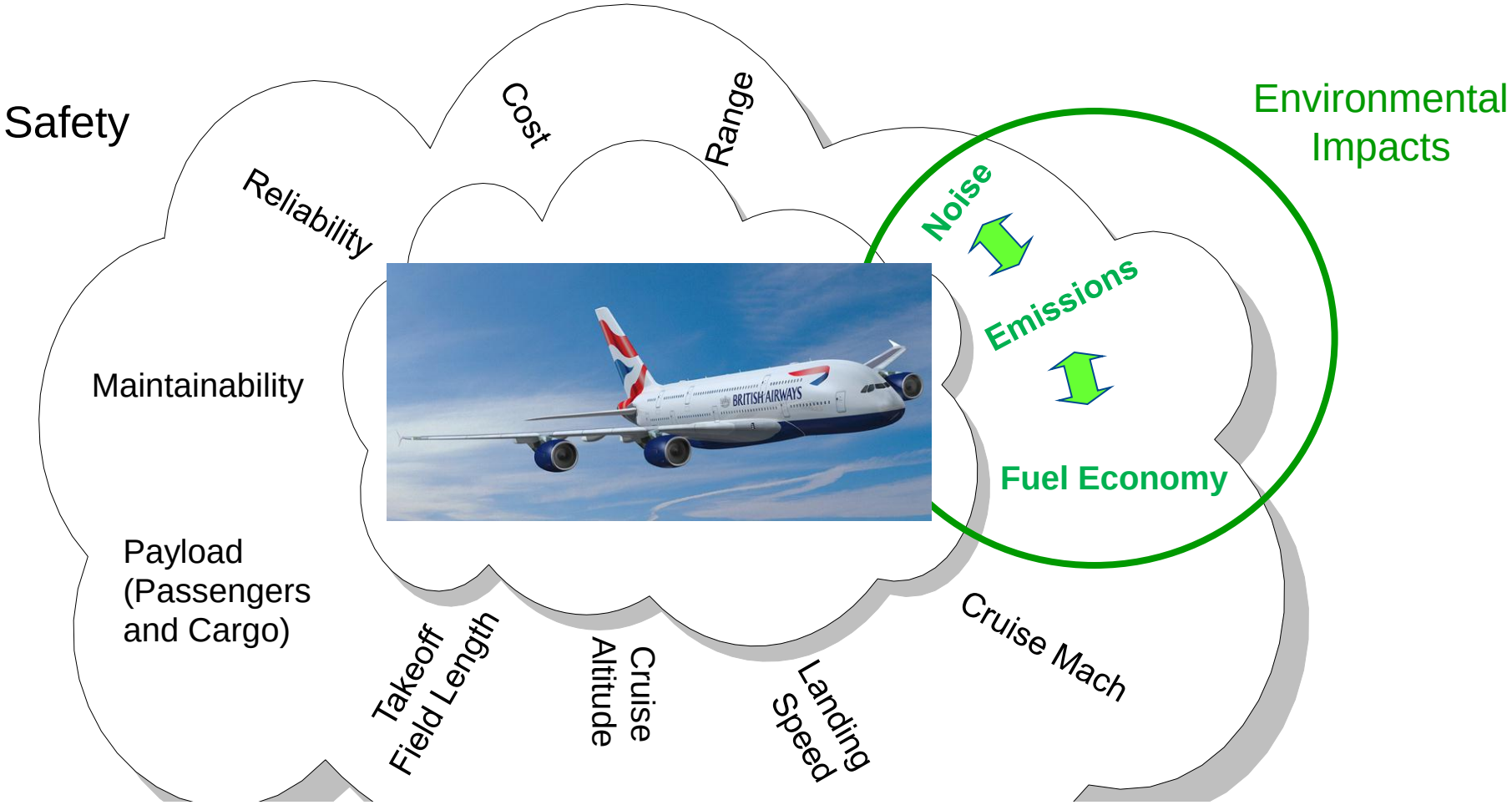
The Balanced Aircraft Design



Achieving low noise levels is a very important parameter in the optimizing process

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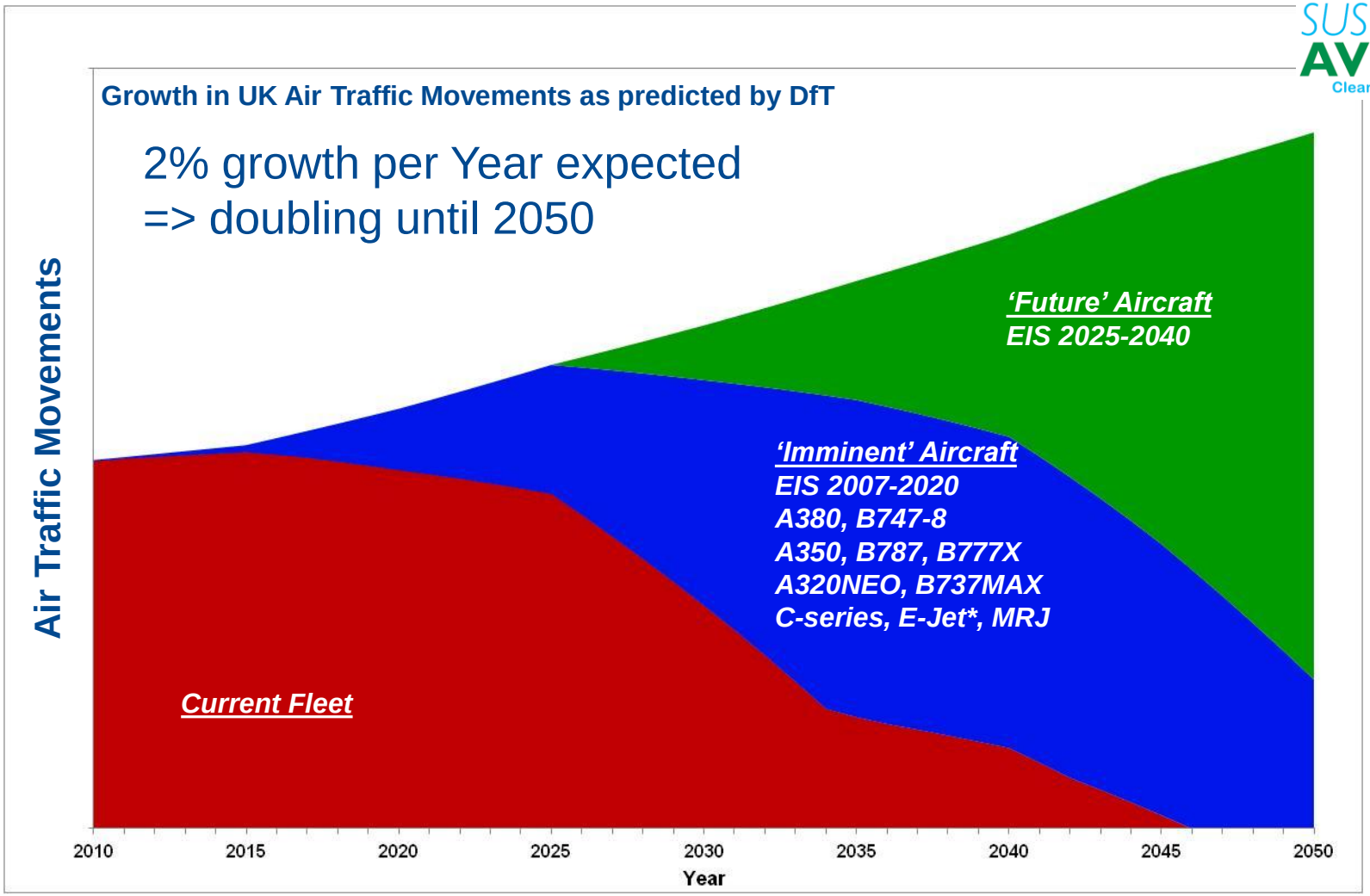
Predicted UK growth of Traffic Movement

SUSTAINABLE AVIATION
Cleaner. Quieter. Smarter.



Source: report "The SA Noise Road-Map" link: www.sustainableaviation.co.uk

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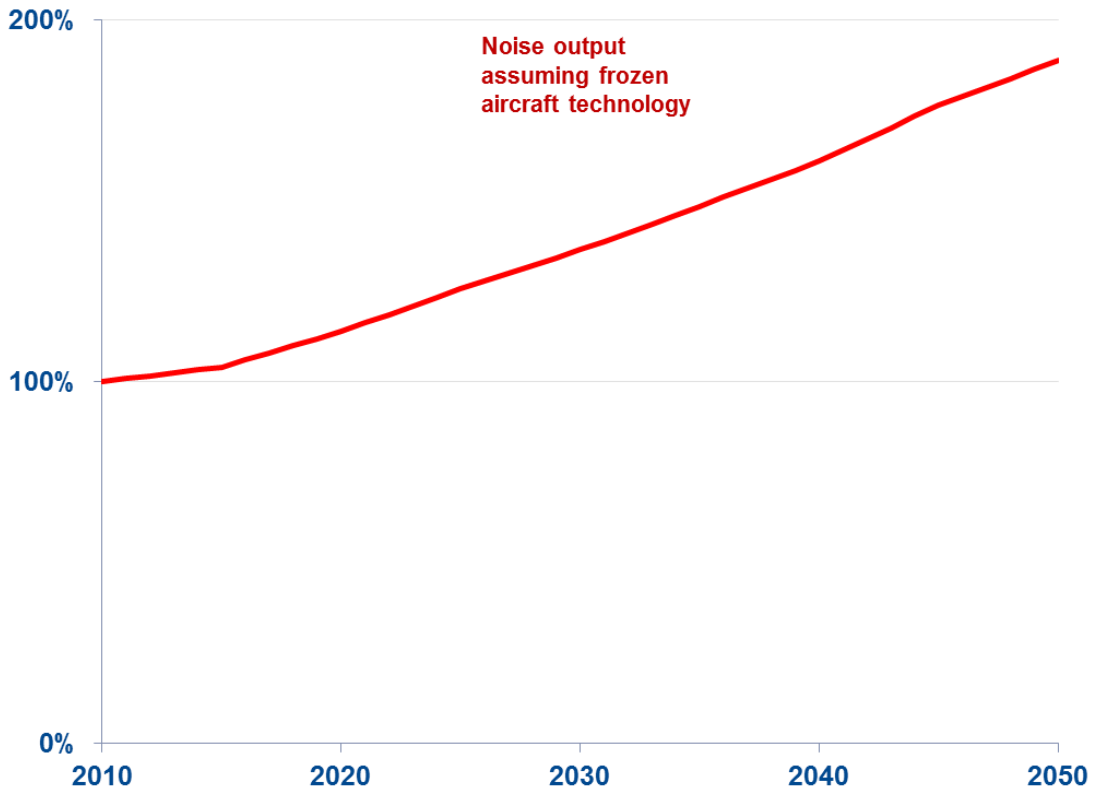
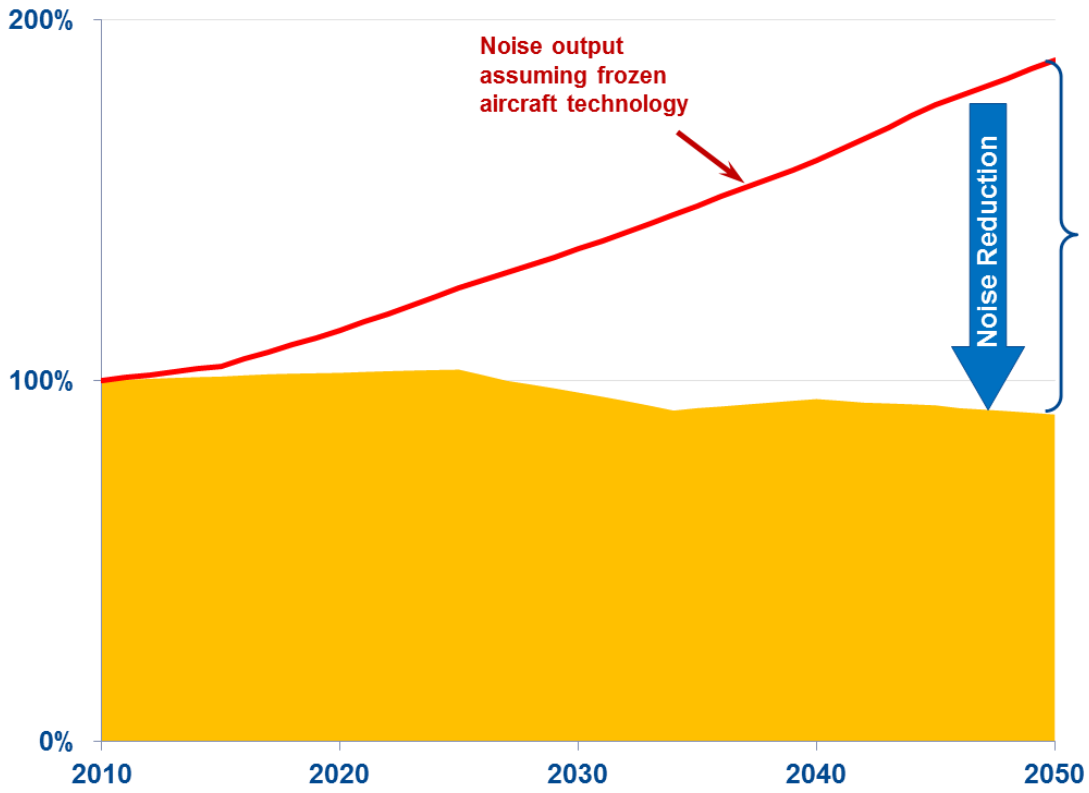
Study of Noise Level Development



Study of Noise Level Development



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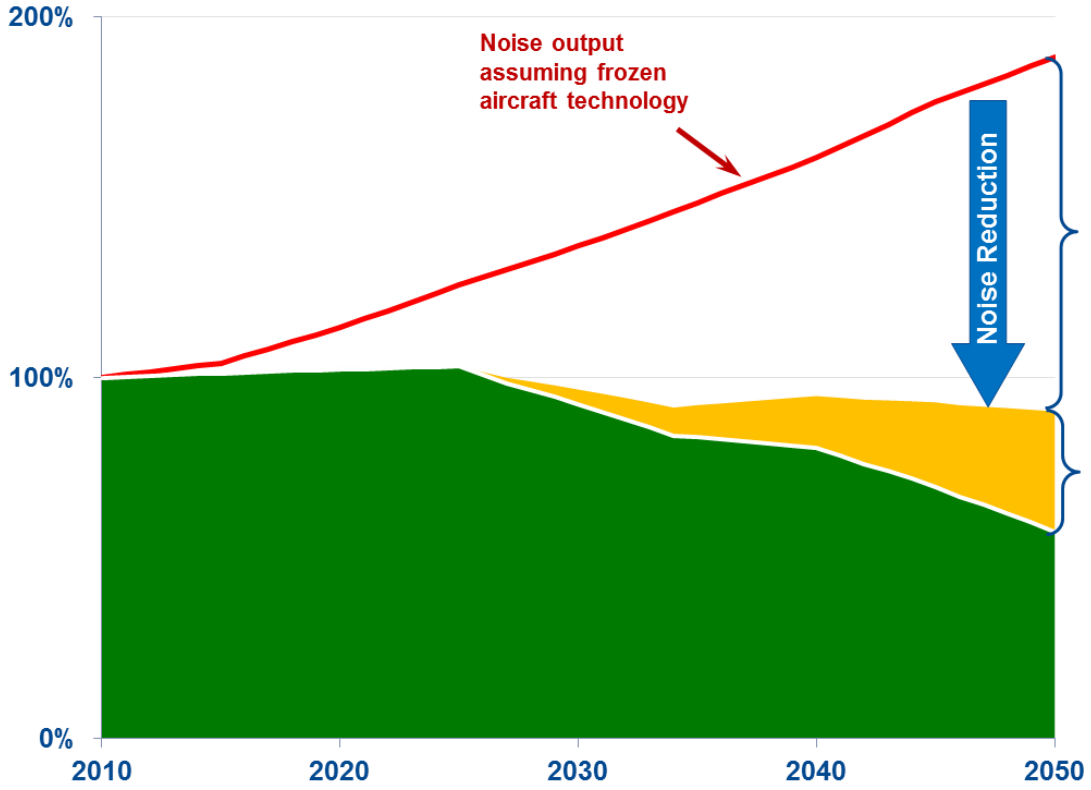

Predicted UK aviation growth to 2050 can be achieved whilst reducing aviation noise output

Summary

- About two thirds of over 1000 million € spent in R&D is addressing the environment
- Low noise & emission is a driver in new engine concepts
- Affordability of programmes and products with revolutionary technologies is critical
- Industry must remain competitive to be able to influence the worldwide market in this field
- Consistent policy and support framework
- Rolls-Royce continues with high effort to further reduce the environmental noise levels of aircrafts

Rolls-Royce