

SW01 Einführung in AvBa

Intermodalität (IM): Mehrere Verkehrsmittel
Serielle IM: Nacheinander
Parallele IM: Nebeneinander
Interoperabilität: Zusammenarbeit desselben Verkehrsmittels
Innere Gefahr: Human Factor, Technik
Äußere Bedrohungen: Terror
Safety: Innere Sicherheit
Security: Äußere Sicherheit
Großkreis: größter Kreis auf Kugel
Meridian: Pol zu Pol (Halbkreis)
Orthodrome: ein Großkreis
Loxodrome: rhumb line Schneidet Längengrad
Längengrad: Longitude lambda
Breitengrad: Latitude phi
ICAO: Int. Civil Aviation Org.
SARP: Standards and Recommended Practices
AIP: Aeronautical Inf. Publication
Erde um 23.45 Grad gesenkt
Januar Abstand 147 Mio Km zur Sonne
Juli Abstand 152 Mio Km zur Sonne
Schweiz in der Zeitzone Alpha
Spring forward fall back
UTC = GMT Greenwich Time
Eastbound: Zeitdiff minus
Westbound: Zeitdiff Plus

SW02 Geschichte & Org.

Versuch zu Fliegen wie Vögel
Mongolfiere Réveillon 1738 Heissluftballon
1883 Erstes Luftschiff (Zeppelin)
1890 Otto Lilienthal Grundlagen Aerodynamik
1903 Gebrüder Wright 12PS
Problem Frühzeit Luftfahrt nicht rentabel
1919 CH Fluggesellschaft
1922 Erster CH Linienflug
1931 Aus Balair und Ad Astra wird Swissair
1933 Boeing 247 Erstflug 10PAX
1946 Erste Linie zwischen NY und GVA
1948 Flughafen Zürich eröffnet
1957 Fluglärm Grund für Ablehnung Ausbau FLZ
1970 B747 DC-10 Grossraumflug .
1972 Markteintritt Airbus
Ab 1980 Liberalisierung Luftmarkt
IGO: Int. government org. zB. ICAO ECAC
INGO: Int. nongovernment org. zB. IATA
NAA: National Aviation authorities zB. BAZL FAA
CINA Vorgänger der ICAO
53 Staaten aus der Chicago Konf.
ICAO Sonderorg. der UNO
193 Mietglieder heute
ICAO Darf keine Gesetze erlassen. Daher gibt es Richtlinien

(Standards). Empfehlungen, Verfahrensvorschriften, Dokumente
SARPS 19 Annexe
CH durch ABIS Gruppe vertreten zusammen mit ÖE,BEL,KRO,NL, LUX,IRL,POR
Erlasse der ICAO werden rechtskräftig, wenn sie durch Nat. Recht übernommen werden.
IATA: Int. Air Traffic Assoc.
IATA regelt Zahlungsverkehr und Ticketing (interline-System) , reisen mit verschiedenen Airlines)
ECAC: European Civil Aviation Convention
Eine IGO regional der ICAO
Nur beratende kraft
EASA: European union aviation safety agency
EASA fast alle Aufgaben der ECAC übernommen
GB nicht mehr bei der EASA
Schweiz im VR ohne Stimmrecht
Sicherheit, Lizenzen, Unterhalt, Betrieb, Sicherung, Regeln
FAA: Federal Aviation Administr.
FAA und EASA Anerkennung

SW03 Emergency Response

ERP: Emergency Response Plan
3C: Command, Communication, Care
Care Team so gross wie grösstes LFZ
Chaosmassnahmen, Optionen erarbeiten, Aufräumen
Event + Response = Output
IED: Improvised explosive device
Security methoden: Visuel, Scanner, Metalldetektor, Explosion's detector
Tigers: Air Marshalls CH
Foxes: ground agents
Tigers Foxes und Bodyguards können Waffen an Bord nehmen

SW03 Aircraft System 2

4 forces: thrust, drag, lift weight
Wing: Generate Lift, Fuel Storage
Fuselage: Space payload PAX
Empennage (Leitwerk): Stability and Control
Landing Gear: Taxi Break
Propulsion system: Thrust

SW04 Aircraft System 3

Business Jet biggest energy consumer
Wright Flyer 0.1 kW/Kg, GE90 6 kW/Kg
6.2 Mio. Barrels Fuel per Day, 1 Barrel = 159 Liters
Battery too heavy for normal Airlines
Modern Engines have many Electrical generators
System: Combi of Parts
ATA Technical Documents:
AFM: Aircraft flight Manual
AOM: Aircraft operating Manual
IPC: Illustrated Part catalogue
AMM: Airplane Maintenance Manual

SRM: Structural Repair Manual
WDM: Wiring Diagram Manual
EM: Engine Manual
Failer Types:
1. Function unusable
2. Function incorrect
3. Function is provided when not used
Safe-Life: System will survive a specific design life without failures
Fail-Safe: a Failure will cause no ir minimum harm
Fault-tolerant: System can operate without this part

SW05/SW07 Aerodro. & ADS_B

ADS-B: Automatic Dependent Surveillance Broadcast
Transmits position to all receivers via satellite
On ground and in air
R-c value determs how good the signal is
NAC_p: Navigational accuracy category – position
EPU: Estimated Position uncertainty (horizontal)
VEPU: Vertical estimated Position uncertainty
NAC_v: Navigational accuracy category Velocity
R_c: Horizontal containment radius limit
Syrien sendet stör Signale daher sind die daten dort sehr schlecht.
Linear Concept: Mauritius
Fingerdock: Singapore
Satelliten: Dubai
Open Apron: Maldives
Hybrid Concept: Gates + Bus

SW06 METEO

Temp. Zunahme durch die Ozonschicht da Sauerstoff absorbiert die Sonnenstrahlen
Isothermie: Temperatur bleibt gleich
Druckabnahme rund 28 ft/hPa oder 11.57 hPa/100m
Die Luftdichte (air density) ist linear proportional zum Luftdruck dividiert zu der absoluten Temperatur
ISA: Int. Standartatmosphäre durch die ICAO definiert
Trockene Luft Bestandteile:
1. 78% Stickstoff N ₂
2. 21% Sauerstoff O ₂
3. 1% Argon
4. 0.04% Kohlstoffdioxid
5. Weitere Spurengase
Wetterprognose: Wetter next days
Klimaprognose: Klima next years
Diskretisierung des Erdballs: Aufteilung in einzelne Raster für bessere daten und vorhersagen
Wetterdaten kommen von: Flugzeugen, Satelliten, Ground stations, ocean data buoy, Schiffe, Radars, Ballone
Fehlerquelle sind falsche Daten oder fehlende Daten

Globalwettermodell: ECMWF 1 Pixel rund 9 Km
Mesoskalenmodell: AROME 1 Pixel rund 1.3 Km
Unfälle durch Wetter werden seltener durch die Verbesserung des Radars
SW08 Flight Operations
ATC-Service: Prevent collision between aircraft, objects and expedite and maintain an orderly flow of air traffic
FI-Service: Advice and informations for flights safety and efficiency
Flightplan shall be submitted when: IFR flight, across borders, 60 min prior departure
Difference CH und ICAO also submit flight plan when: ATC service provided, when required by ATS for FL, when required by ATS for coordinating military(identification)
Swiss AIP: Air information Publications Int. Flights, IFR/VFR, night VFR, Flights out of ZRH, FP can be filed out 10 min prior it's need (VFR 0 befor)
Rules Avoidance of Collisions <ol style="list-style-type: none"> Head on, each shall alert it's heading to the right Converging, the aircraft that has the other on it's right shall give way Except, Power-Driven give way to airships to gliders to balloons
Int. Emergency Codes 7500 hijacking, 7600 loss of communication, 7700 Gen.emergency
CH Codes 6100 MIL VFR, 7100 SAR, 7000 VFR Flights
VFR Flight rules: 300m/1000ft above housed field 150m/500ft above unhoused filed FL plus 5 to the IFR Flight levels
IFR flight rules: Maintain two-way COM Submit a flight plan Min 1000ft over land Min 2000ft over mountains
Aerial work: Photography, search and rescue, advertisement
Commercial air transport operation: Normal commercial Flights
Network/Hub: Swiss Wave System Shorthaul feeds longhaul
Point to Point: EasyJet
Charter: Helvetic, Execujet
ACIM: Aircraft, Crew, Maintenance, Insurance
ACM: Accountable Manager
CMM: Compliance Monitoring Manager
SMM: Safety Monitoring Manager

NP FO: Nominated Person ground Operations
NP CT: Nom. Per. Crew Training
PCA: Post Holder Continuing Airworthiness
SW09 Safety Risk Management
Risk identification: Risikomanagement ist nie Komplet und genügt nicht als Schutz Classification if frequent or sever
Risk treatment: Avoiding, Taking, Transferring, mitigating risk by changing likelihood operations
Learn from incidents and accidents
Risk Management line of defense: Ownership: make the rules QS: check if the rules are followed Internal audit: Check if rules are helpful
Reporting culture: Report near misses and errors
Flexible culture: less speed more focus on safety
Informed culture: Knowledge
Just culture: atmosphere of trust
Learning culture: Learn from the past
SW10 BAZL
BAZL unterliegt dem UVEK
BAZL sorgt für unabhängigen und sicheren Luftverkehr. Oberaufsicht liegt im Parlament
System Luftfahrt CH: Regulator, Regel setzend und Regel durchsetzend. BAZL hat auch die Polizeilizenz Provider, DL und hoheitliche Leistungen im Auftrag Regulator Skyguide, Meteo Operator und Organisator, Private unternehmen welche DL in der Luftfahrt anbieten
Seit 2018 in der CH auch eine militärische Luftfahrtbehörde MAA (Military Aviation Authority)
LUPO: <ul style="list-style-type: none"> Schweiz Anbindung an Luftverkehr SIL Sicherheit Organisation der Flugsicherung Ausbildung und Forschung Neue Technologien
Luftfahrtentwicklung: Nachhaltigkeit stütz sich auf drei beine: <ul style="list-style-type: none"> Ökologie Soziale Auswirkungen Ökonomie
Sachpläne der CH <ul style="list-style-type: none"> Fruchtfolgeflächen Übertragungsleitung Militär und Waffenplatz AlpTransit Verkehr(Strasse, Zug, LF)

SIL Konzeptteil: Generelle Ziele und Vorgaben zur Infrastruktur Objektteil konkretisiert die Vorgaben aus dem Konzeptteil
Koordinationsprozess: Erarbeitung der Grundlagen des SIL
Objektblattverfahren: Anpassung Objektblatt Anhörung Bevölkerung und Behörden
SPD: EASA Single Programming Document -> Alle 3 Jahre Mehrjahressicht aller Aktivitäten
BAZL will hohe Sicherheit und Nachhaltigkeit
SSP: State Safety Programm braucht laut ICAO jeder Staat, um ALoS zu erreichen
ALoS: acceptable level of safety
ETTO: Efficiency- thoroughness-trade- off
Oberst gebot der Sicherheitsaufsicht ETTO: Nicht primär polizeiliche Überwachung mehr Anleitung und Ausbildung. Sanktionen nur wenn es vorsätzlich oder grobfahrlässig war.
CH Luftverkehr Ca 1% des Weltweiten Luftverkehrs
CORSIA ICAO Programm zur Emissionsreduktion
SW11 Human Factor
80% of Accidents caused by human error
Interaction Person w/ Tesk w/ Equipment w/ Environment
SW12 Space/ Zukunft
1 Kg kostet etwa 1000 CHF im All
Neigung/Inklination gibt an wie nördlich/südlich ein Satellit durchfliegt
Instrument Concept: <ul style="list-style-type: none"> Line Scanner Single Line Whskbroom Scanners Multiple lines Pushbroom scanners Frame sensor/video
EU-Kommission Ziele für die Luftfahrt: von 2000 Per 2050 <ul style="list-style-type: none"> 75% weniger CO2 Emissionen pro Passagierkilometer 90 % Reduktion der Nox Emissionen pro Passagierkilometer 65% min. Senkung der Lärmemissionen
Clean sky 2 Ziele von 2008 mit 1.6B Euro über sieben Jahre
SW13 SUST
ICAO Annex 13: Verordnung über die Sicherheitsuntersuchung von Zwischenfällen im Verkehrswesen
Ziele einer Untersuchung: <ul style="list-style-type: none"> Was? Warum? Wie verhindern?

SUST ist eine ausserparlamentarische Untersuchung Stelle
Die SUST darf niemanden beschuldigen sie muss Fakten nennen und im Sinne der Sicherheit beurteilen
SUST kann aussagen ohne Einverständnis verwenden
SUST mach nur Empfehlungen
Just Culture: Fehler machen ist erlaubt Fehler verschwiegen nicht
Ablauf einer Sicherheitsuntersuchung
<ul style="list-style-type: none"> • Meldung • Beurteilung des Ereignisses • Untersuchungshandlungen • Entwurf Schlussbericht • Qualitätskontrolle • Betroffene Verkehrskreise können Stellung beziehen • Bei begründetem Einwand: Korrektur oder Ergänzung • Schlussbericht

66.A.3 Licence categories

(a) Aircraft maintenance licences include the following categories:

- Category A
- Category B1 (Certifying Staff & Support Staff)
- Category B2 (Certifying Staff & Support Staff)
- Category B3 (see paragraph (c))
- Category C (Certifying Staff)

(b) Categories A and B1 are subdivided into subcategories relative to combinations of aeroplanes, helicopters, turbine and piston engines. These subcategories are:

- A1 and B1.1 Aeroplanes Turbine
- A2 and B1.2 Aeroplanes Piston
- A3 and B1.3 Helicopters Turbine
- A4 and B1.4 Helicopters Piston

(c) Category B3 is applicable to piston-engine non-pressurised aeroplanes of 2 000 kg MTOM and below.

SW12 Zusatz

	Clean Sky 2 as proposed*
CO ₂ and Fuel Burn	-20% to -30% (2025 / 2035)
NO _x	-20% to -40% (2025 / 2035)
Population exposed to noise / Noise footprint impact	Up to -75% (2035)

* Baseline for these figures is best available performance in 2014

SW14 Aircraft System 1

CAMO: Continuing Airworthiness Management Organization
MRO: Maintenance Repair & Overhaul Organization
MEL: Minimum Equipment List
Part-M: Owner, Operator, Airline, CAMO
Part-145: MRO, "Garage"
CAMO has to look for every aspect which contains the aircraft and it's operation. Such as all EASA parts are fulfilled, Operation according to the current MEL , Maintenance program is fulfilled, Pilot Trainings are performed and monitored
NPCA: Nominated Person for Continuing Airworthiness
Contracting of CAMO is not Allowed Swiss can sub-contract Part-M Tasks to SR Technics. But further sub-contracting is not allowed
Contracting of Part-145 Tasks is possible even sub-sub-contracting. But the CAMO is still job of the Airline.
Whatever an Airline sub-contracts the Continuing Airworthiness is still their Part
<p>Operator / Airline A</p> <p>Part-M or Part CAMO approved (CAMO)</p> <ul style="list-style-type: none"> - Enough CAMO staff to comply with Part-M - Part-145 approved with all capabilities for aircraft, engine and APU maintenance - Part-145 approved with all capabilities for component maintenance - Part-66 approved - Part-147 approved
<p>Operator / Airline B</p> <p>Part-M or Part CAMO approved (CAMO)</p> <ul style="list-style-type: none"> - Enough CAMO staff to comply with Part-M - Part-145 approved with Aircraft Line maint. capability - Part-66 approved - Part-147 approved
<p>Operator / Airline C</p> <p>Part-M or Part CAMO approved (CAMO)</p>

Take Home Message

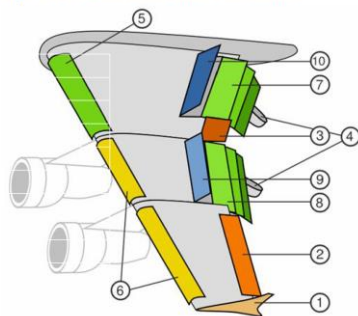
- Die Forschung und Entwicklung wird gemäss Technology Readiness Levels TRL eingestuft (Beurteilung Reifegrad der Entwicklung).
- Eine Fachhochschule ist in TRL 4 bis 9 tätig.
- Clean Sky 1 und 2 ist das grösste Luftfahrt Forschungsprogramm, dass es je gab.
- Im Clean Sky 2 Projekt sollen Plattformen als Demonstratoren entwickelt werden für folgende Konfigurationen:
 - New Narrowbody
 - New Widebody
 - New Regional & Business Jet
 - New Rotorcraft
- Das oberste Ziel ist eine nachhaltige Entwicklung der Luftfahrt in Europa mit der Flightpath 2050 Vision
 - 75% weniger CO₂ Emission pro Passagierkilometer
 - 90% Reduktion NO_x Emissionen pro Passagierkilometer
 - Die Lärmemission soll um 65% reduziert werden

SW14 Zusatz

- Basic Regulation **EC 2018/1139** (common rules in the field of civil aviation)
- Initial Airworthiness **Reg 748/2012**
 - **Part-21** (laying down implementing rules for the airworthiness and environmental certification of aircraft and related products, parts and appliances, as well as for the certification of design and production organisations). Certification specifications (CS) are based on this regulation and must be fulfilled by manufacturers prior to final certification ("Musterzulassung" → **Type Certificate**).
- **Continuing Airworthiness Reg 1321/2014** (covering continuing airworthiness of aircraft and aeronautical products, parts and appliances, and on the approval of organisations and personnel involved in these tasks)
 - ANNEX I: **PART-M** (Continuing Airworthiness Requirements)
 - ANNEX II: **PART-145** (Maintenance Organisation Approvals)
 - ANNEX III: **PART-66** (Certifying Staff)
 - ANNEX IV: **PART-147** (Training Organisation Requirements)
 - ANNEX Vc: **PART-CAMO** (Continuing Airworthiness Organisation Requirements)

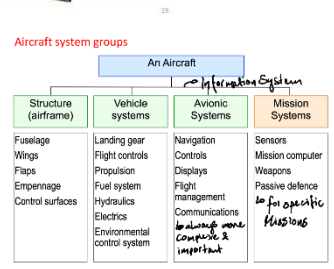
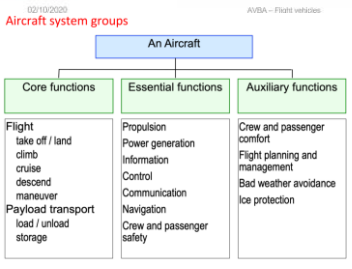
SW03 Aircraft System

Control surfaces, high lift devices and other elements



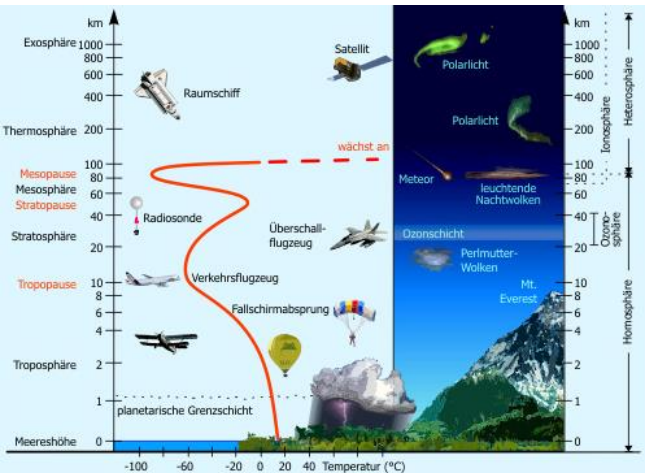
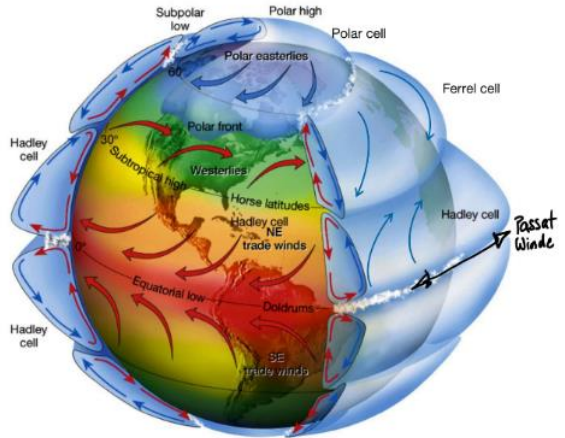
- 1 Winglet
- 2 Low speed aileron
- 3 High speed aileron
- 4 Flap track fairings
- 5 Kruger flap
- 6 Slat
- 7 Inboard flap
- 8 Outboard flap
- 9 Outboard spoiler
- 10 Inboard spoiler

CH used:
C, D, E, G
others not used in CH



Minor	no significant reduction in airplane safety	some physical discomfort to PAX and Crew
Major	significant reduction in safety margin, increase in crew workload	possibly including injury
Hazardous	Large reduction in safety margins	Serious or fatal injury to occupants
Catastrophic	Multiple fatalities of the occupants	Serious or fatal injury to flight crew, loss of the aircraft

SW06 METEO



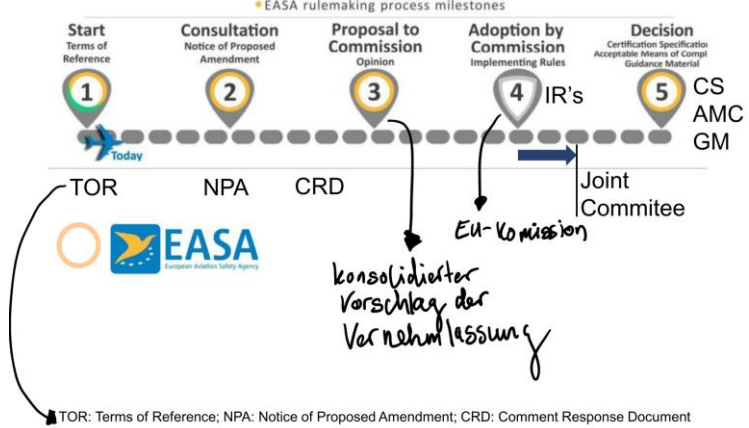
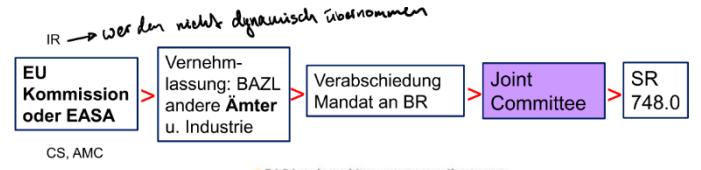
Technology Readness Level für Forschung und Entwicklung

- TRL 9 Operations: System Proven and Ready for Full Commercial Deployment: Actual system proven through successful operations in operating environment, and ready for full commercial deployment.
- TRL 8 Active Commissioning: System Incorporated in Commercial Design: Actual system/process completed and qualified through test and demonstration (pre-commercial demonstration).
- TRL 7 Inactive Commissioning: System Demonstrated: System/process prototype demonstration in an operational environment.
- TRL 6 Large Scale: Prototype System Verified: System/process prototype demonstration in an operational environment (beta prototype system level).
- TRL 5 Pilot Scale: Laboratory Testing of Integrated/Semi-Integrated System: System component and/or process validation is achieved in a relevant environment.
- TRL 4 Bench Scale Research: Design, development and lab testing of components/processes. Results provide evidence that performance targets may be attainable based on projected or modeled systems.
- TRL 3 Proof of Concept: Critical Function or Proof of Concept Established: Applied research advances and early stage development begins. Validate analytical predictions of separate elements of the technology.
- TRL 2 Invention and Research: Basic Research for Applications: Initial practical applications are identified. Potential of material or process to solve a problem, satisfy a need, or find application is confirmed.
- TRL 1 Basic Principles: Basic Research for Innovations: Initial scientific research has been conducted. Principles are qualitatively postulated and observed. Focus on new discovery rather than applications.

SW08 Flight Areas

Class	Type of flight	Separation provided	Service provided	Speed limitation*	Radio communication requirement	Subject to an ATC clearance
A	IFR only	All aircraft	Air traffic control service	Not applicable	Continuous two-way	Yes
	IFR	All aircraft	Air traffic control service	Not applicable	Continuous two-way	Yes
B	VFR	All aircraft	Air traffic control service	Not applicable	Continuous two-way	Yes
	IFR	IFR from IFR IFR from VFR	Air traffic control service	Not applicable	Continuous two-way	Yes
C	VFR	VFR from IFR	1) Air traffic control service for separation from IFR; 2) VFR/VFR traffic information (and traffic avoidance advice on request)	250 kt IAS below 3 050 m (10 000 ft) AMSL	Continuous two-way	Yes
	IFR	IFR from IFR	Air traffic control service, traffic information about VFR flights (and traffic avoidance advice on request)	250 kt IAS below 3 050 m (10 000 ft) AMSL	Continuous two-way	Yes
D	VFR	Nil	IFR/VFR and VFR/VFR traffic information (and traffic avoidance advice on request)	250 kt IAS below 3 050 m (10 000 ft) AMSL	Continuous two-way	Yes
	IFR	IFR from IFR	Air traffic control service and, as far as practical, traffic information about VFR flights	250 kt IAS below 3 050 m (10 000 ft) AMSL	Continuous two-way	Yes
E	VFR	Nil	Traffic information as far as practical	250 kt IAS below 3 050 m (10 000 ft) AMSL	No	No
	IFR	IFR from IFR as far as practical	Air traffic advisory service; flight information service	250 kt IAS below 3 050 m (10 000 ft) AMSL	Continuous two-way	No
F	VFR	Nil	Flight information service	250 kt IAS below 3 050 m (10 000 ft) AMSL	No	No
	IFR	Nil	Flight information service	250 kt IAS below 3 050 m (10 000 ft) AMSL	Continuous two-way	No
G	VFR	Nil	Flight information service	250 kt IAS below 3 050 m (10 000 ft) AMSL	No	No

SW10 BAZL



	ICAO	EASA
Regulierungen	Standards	IR's (AR's and OR's)
	Recommendations	CS, AMC, AltMoC, GM

- IR: Implementing Rule
- AR: Authority Requirement
- OR: Organisation Requirement
- CS: Certification Specification
- AMC: Acceptable Means of Compliance
- AltMoC: Alternative Means of Compliance
- GM: Guidance Material

SW11 Human Factor

Entwicklungszyklus für interaktive Systeme nach DIN-EN ISO 9241-210

