

Production flight test department
Andreas BALK
Flight Test Engineer

**FLIGHT TEST
ON
PRODUCTION AIRCRAFT**

Hamburg Aerospace Lecture Series (DGLR, RAeS, VDI, ZAL, HAW Hamburg)

Andreas Balk:

"Production Flight Test of Passenger Aircraft at Airbus"

12.04.2018

Hamburg University of Applied Sciences (HAW Hamburg)

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<http://hamburg.dgfr.de>

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HAW Hamburg in cooperation with the RAeS, DGLR, ZAL and VDI invites to a lecture



Production Flight Test of Passenger Aircraft at Airbus

Dipl.-Ing. **Andreas Balk**,
Production Flight Test Department, Airbus

Date: Thursday, 12 April 2018, 18:00

Location: HAW Hamburg

Berliner Tor 5
Hörsaal 01.12

Lecture followed by
discussion.
No registration required !
Entry free !

In 2017 Airbus delivered a record 718 aircraft to its customers. Before its delivery each individual aircraft has to pass a ground and flight test phase to obtain the certificate of airworthiness. This lecture gives an overview of the production flight testing in an industrial environment. It describes the series of tests from the moment the aircraft leaves the final assembly line until its delivery to the customer. Flight test engineer Andreas Balk is part of the production flight test department team at Hamburg Finkenwerder and will provide an inside view on his daily work testing A320 family and A380 production aircraft.

Andreas Balk graduated in 1989 from Technische Universität Berlin in aeronautical engineering. From 1989 until 1992 he worked at MBB Ottobrunn/Manching doing flight test data analysis for handling qualities. In 1992 he joined Airbus Industrie in Toulouse in the flight operations department being involved in the A340/A330 entry into service. From 1997 onward he was trained to become flight test engineer and completed his training at EPNER in 2000. Since then he is flight testing A320 family and A380 aircraft in Toulouse and Hamburg. In 2014 and 2015 he was head of production flight test department at the final assembly line in Tianjin, China. Andreas flies glider planes as pilot and instructor.



Fotos: Balk

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Scope

- What is Production Flight Test ?
- Set Up
- Typical First Flight of an A320 family a/c
- Q&A



What is Production Flight Test ?



VS



Development Flight Test

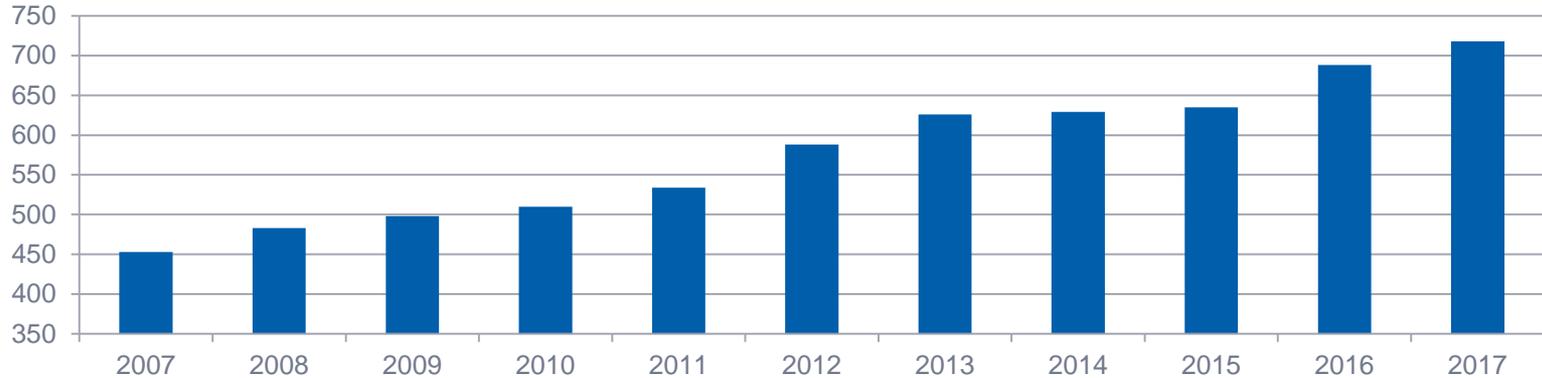
Demonstration of compliance with applicable regulations (EASA, FAA...) with the objective to obtain the Aircraft Type Certificate

Production Flight Test

Demonstrate for each individual aircraft conforms with the certified aircraft type the objective being to obtain the Certificate of Airworthiness

What is Production Flight Test ?

➤ Airbus deliveries:



- Every 7 hours an A320 family aircraft leaves one of the final assembly lines all over the world (Toulouse, Hamburg , Tianjin, Mobile)

What is Production Flight Test ?

- Production flight test of serial aircraft
- Customer acceptance flight
- Technical flights post maintenance, end of leasing
- Additional Type certificate (corporate jets)

What is Production Flight Test ?

Production Aircraft Test (PATM)

First Flight of a new production Aircraft:

The purpose of the PATM is to demonstrate that the aircraft:

- ✓ Conforms with the type and individual certificate to a Certificate of Airworthiness Standard
- ✓ Meets its specifications
- ✓ Meets the standards of quality required for delivery

Under EASA Airbus Production Organisation Approval (POA) , accepted as such by the FAA and most other authorities.

Customer Acceptance Flight (CAM)

Customer technical acceptance of a new aircraft:

To demonstrate the technical compliance with a contract:

- ✓ Compilation of check procedures agreed between Airbus and a Customer
- ✓ Covers both ground and flight checks that can be carried out in any order (Flight before Ground Checks, unlike the PATM)

Not to be used as an airworthiness demonstration:

- ✓ There is no control over the weather
- ✓ Mixing the objective of the flight can create safety issue
- ✓ There is a mixed crew (Airbus/Customer)

In Service Aircraft Technical Flight (ISATFM)

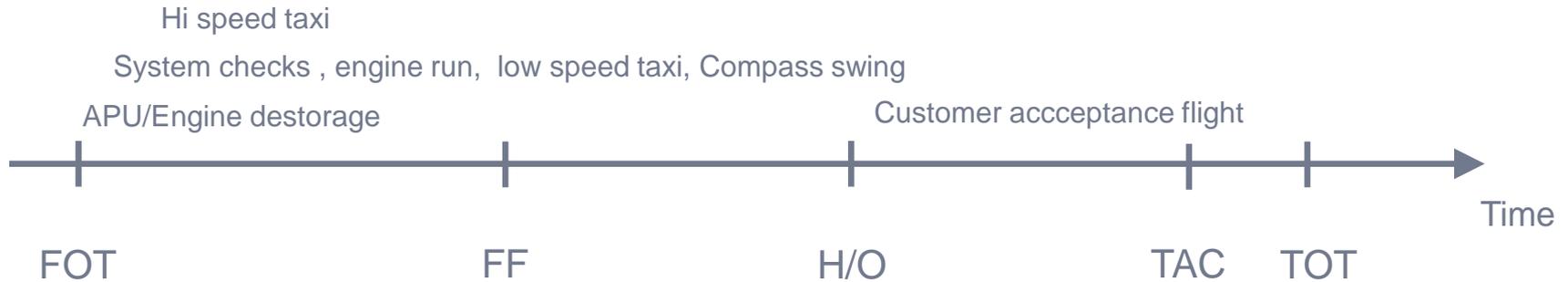
For an **In-Service Aircraft** , after working party or for an aircraft transfer between Airbus and an Operator:

Contains the procedures for ground and flight tests to be performed by Airbus personnel on an in service aircraft
It must be performed in a specified order

Could be handed over to any Customers requested it, prior to a check flight

- ✓ Under a formal process (letter of waiver in pdf)
- ✓ The Customer to create their own check schedule from it, duly considering all the "local" issues

What is Production Flight Test ?



FOT: Final assembly line Operational Test

FF: First Flight

H/O: Hand Over

TAC: Technical Aircraft Completion

TOT: Transfer of Title

What is Production Flight Test ?

- Production flight test starts operation of the completed aircraft
- Production flight test includes ground testing
- Production flight test “in flight” is done because we can not test it on ground

What is Production Flight Test ?

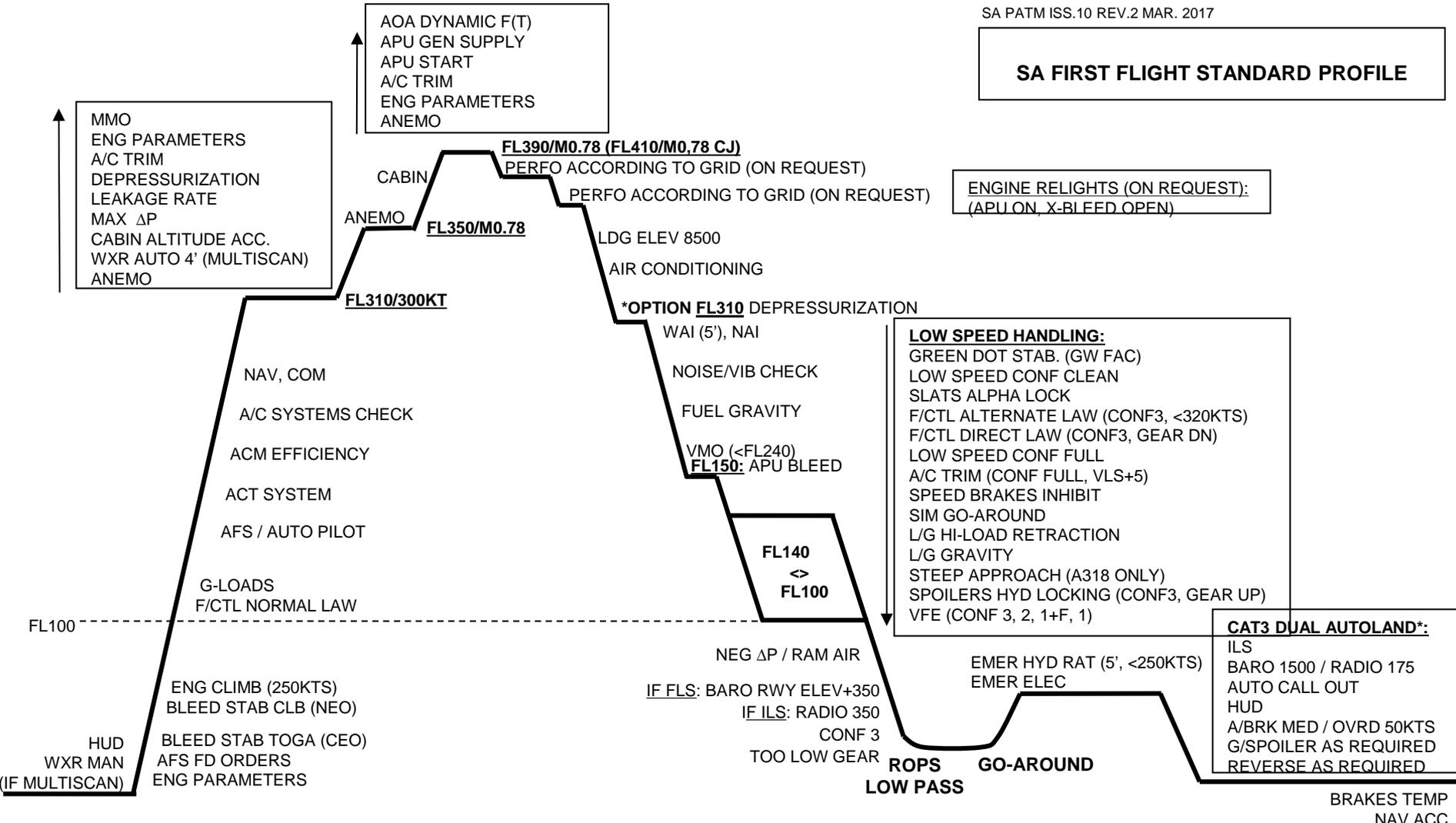
- SYSTEM ground test
- APU and ENGINE run (destorage)
- TAXI check and COMPASS SWING
- REJECTED take-offs



What is Production Flight Test ?

- Safety: “Envelope”, Low speed limits, VMO,MMO, Norm and degraded flight controls laws, Back up systems (Ram Air Turbine, Emergency Generator), APU start, Safety valves
- Efficiency: Anemometry, Performance, Lateral trim, Ram Air Turbine, NAV
- Functionality: Systems, pressurization, Comms, IFE, Galleys, Connectivity
- Comfort: Noise , Smell

SA FIRST FLIGHT STANDARD PROFILE



MMO
ENG PARAMETERS
A/C TRIM
DEPRESSURIZATION
LEAKAGE RATE
MAX ΔP
CABIN ALTITUDE ACC.
WXR AUTO 4' (MULTISCAN)
ANEMO

AOA DYNAMIC F(T)
APU GEN SUPPLY
APU START
A/C TRIM
ENG PARAMETERS
ANEMO

ENGINE RELIGHTS (ON REQUEST):
(APU ON, X-BLEED OPEN)

LOW SPEED HANDLING:
GREEN DOT STAB. (GW FAC)
LOW SPEED CONF CLEAN
SLATS ALPHA LOCK
F/CTL ALTERNATE LAW (CONF3, <320KTS)
F/CTL DIRECT LAW (CONF3, GEAR DN)
LOW SPEED CONF FULL
A/C TRIM (CONF FULL, VLS+5)
SPEED BRAKES INHIBIT
SIM GO-AROUND
L/G HI-LOAD RETRACTION
L/G GRAVITY
STEEP APPROACH (A318 ONLY)
SPOILERS HYD LOCKING (CONF3, GEAR UP)
VFE (CONF 3, 2, 1+F, 1)

CAT3 DUAL AUTOLAND*:
ILS
BARO 1500 / RADIO 175
AUTO CALL OUT
HUD
A/BRK MED / OVRD 50KTS
G/SPOILER AS REQUIRED
REVERSE AS REQUIRED

BRAKES TEMP
NAV ACC

Set Up

➤ Crewing: 3 Cockpit, 1(+) Cabin specialist

➤ Environment: ATC, Airspace, WX

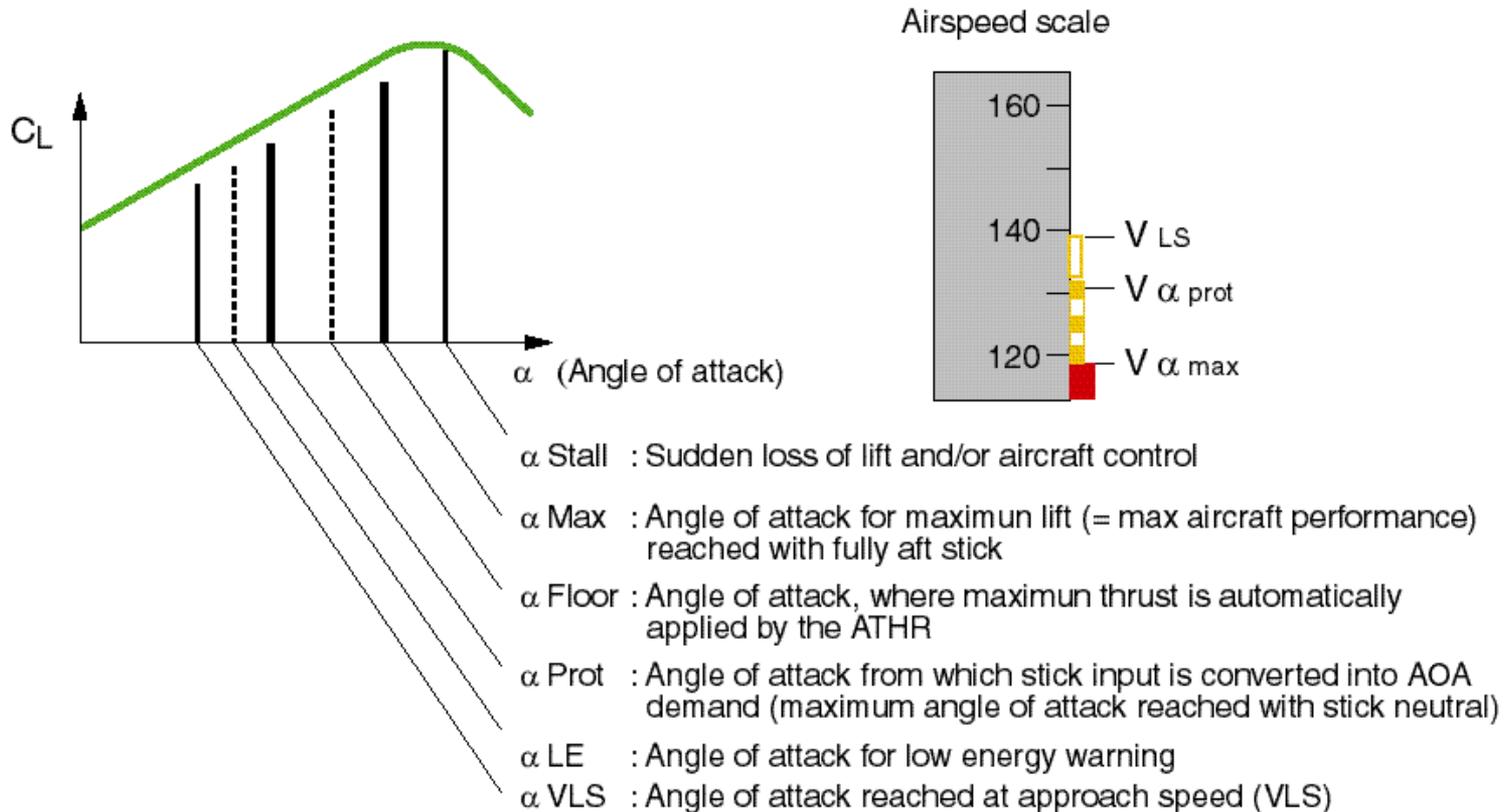
➤ Supporting Test equipment: Cocoto (COckpit COllection TOol)

Damato (DAta MAnagement TOol)

Typical SA First Flight

- Weight by fuel load
- Duration approximate 2,5 h

Low Speed Flight Tests



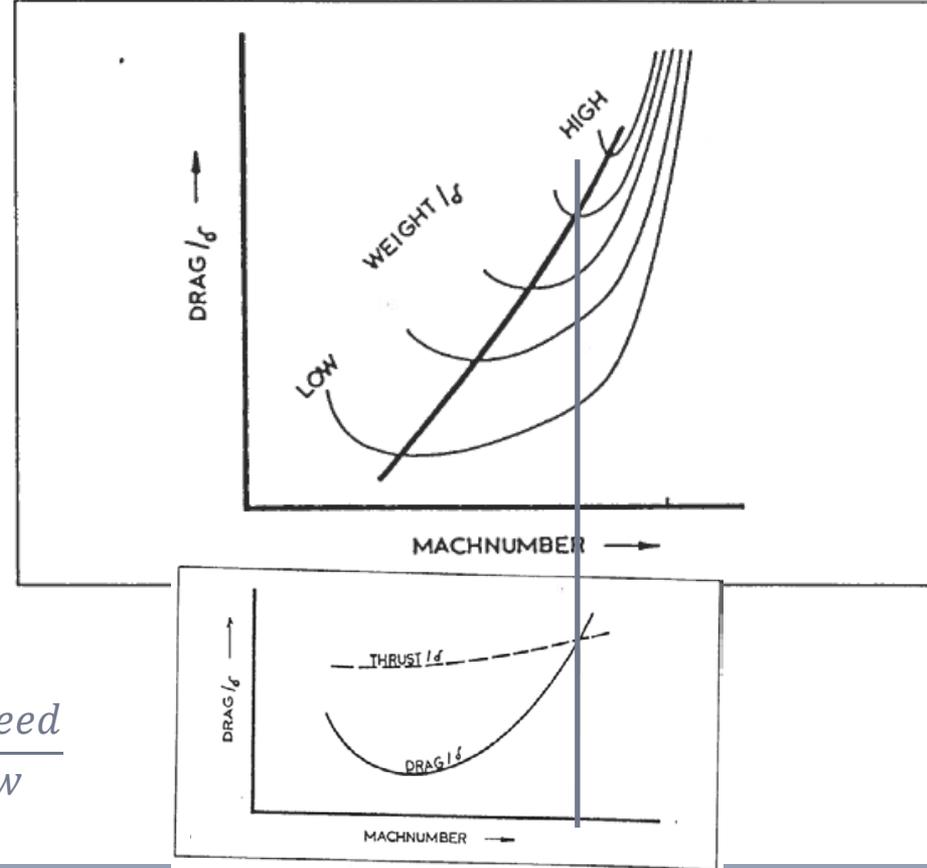
Performance Runs

$$\text{Drag} = \frac{D}{\delta} = 0.7 S C_D M^2$$

$$\text{Lift} = \frac{L}{\delta} = 0.7 S C_L M^2$$

$$\text{with } \delta = \frac{p_s}{p_{s0}}$$

$$\text{specific range} = \frac{\text{still air distance}}{\text{fuel quantity}} = \frac{\text{true airspeed}}{\text{fuel flow}}$$



Performance Runs

- **Fuel sample** (Lower Heat Value)
- **Weighing** (starting value to compute actual weight from fuel used)
- **Bleed configuration** (Packs, Cargo cooling demand)
- **Anemometry** (Altitude, IAS)
- **Lateral trim** (flight control deflection within tolerance, fuel balanced)
- **Meteorological conditions** (Wind, OAT)
- **Data recording**

➤ Q & A