

"Wake Penetration – a tumultuous farewell of 1st Typhoon Prototype Aircraft"



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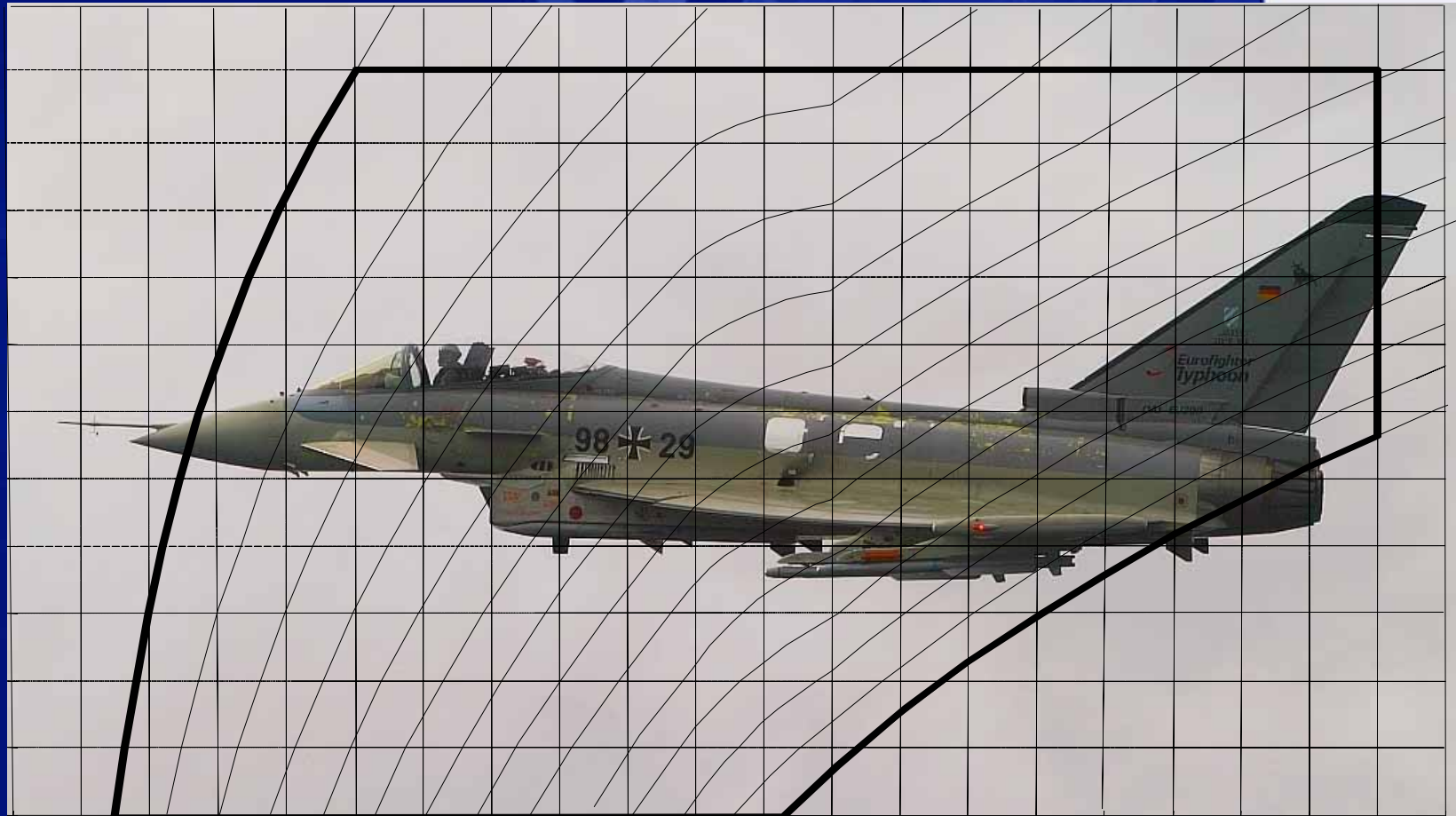
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Contents

- Eurofighter/ Typhoon
4th Generation fighter aircraft
- DA 1
1st Eurofighter/ Typhoon Prototype Aircraft
- Test Objectives
- Test Aircraft / Aircraft Instrumentation
- Test Procedure
- Crossing the Wakes
- Flight Safety Considerations
- Flight Maneuvers
- Inflight Experience
- Test Results

Eurofighter/ Typhoon 4th Generation fighter aircraft



DA 1 1st Eurofighter/ Typhoon Prototype Aircraft



Test Objectives Wake Penetration

- Verification of the robustness of Air Data System and Air Data Transducers (ADTs) against wakes.
- Validation of a combined wakes and flight mechanics model of flight mechanics department
- Verification of the robustness of the FCS (Control Laws) against wakes



Test Aircraft / Aircraft Instrumentation

DA1 (Test A/C):

Noseboom

Differential GPS



VFW-614 (wake producer):

Differential GPS

Smoke Generator

Known wake characteristics



EF DA5 (wake producer):

Differential GPS

Smoke Generator (Smokewinder)



Test Procedure Wake Penetration

- Test Safety Prerequisites
 - Prediction by simulation for safe build up (nz, AoA, ...)
 - Stable atmospheric condition
 - Blue sky to ensure clear visibility of smoke trail of leading aircraft
- Crossing the wakes in defined conditions
 - From high to short distances to lead aircraft
 - From low to high speed
 - From low to high load factors



Build-Up
for risk reduction

Crossing the Wakes

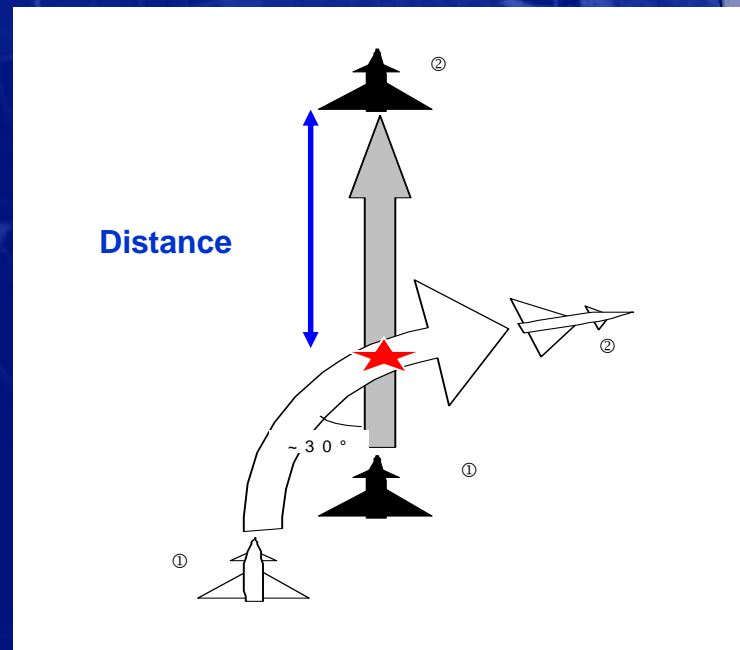
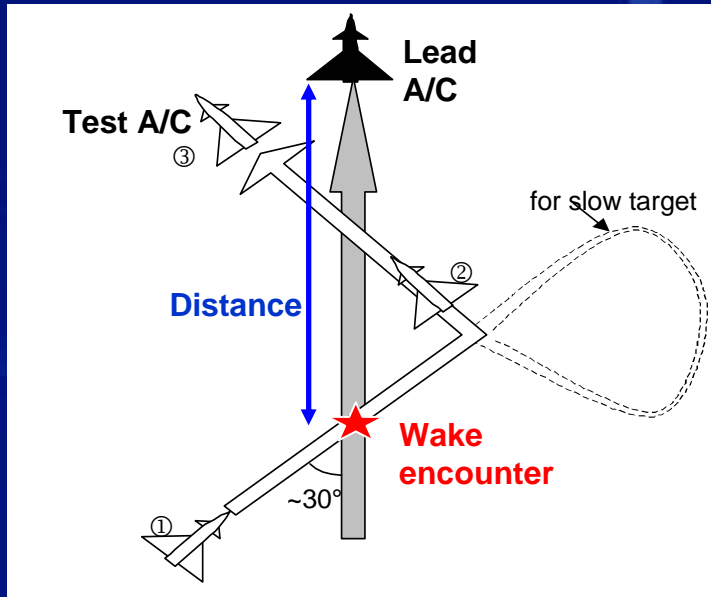


Flight Test Safety Considerations Wake Penetration

- Aircrew briefing (calls, procedures, ...)
- Continuous Quicklook monitoring of ADS and aircraft behaviour (special online calculation routines to evaluate ADS behaviour before proceeding with next wake encounter)
- Defined “Knock Off” criteria

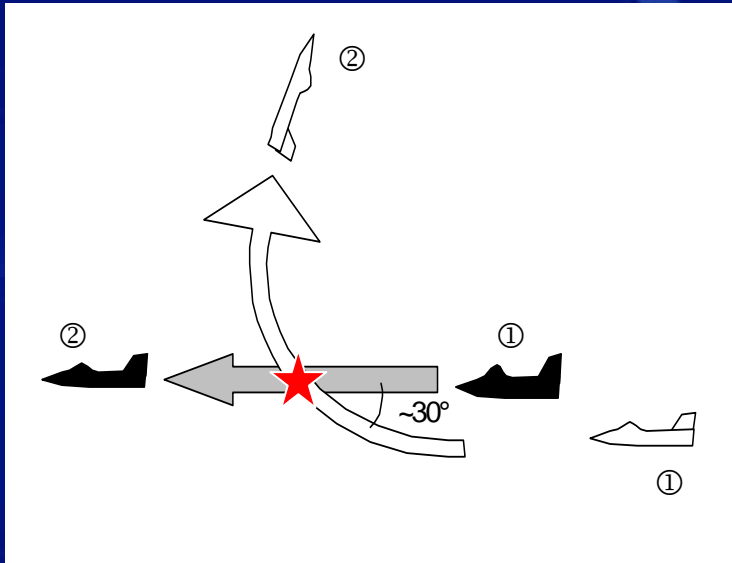
Flight Manoeuvres 1

Straight & Level (1g)



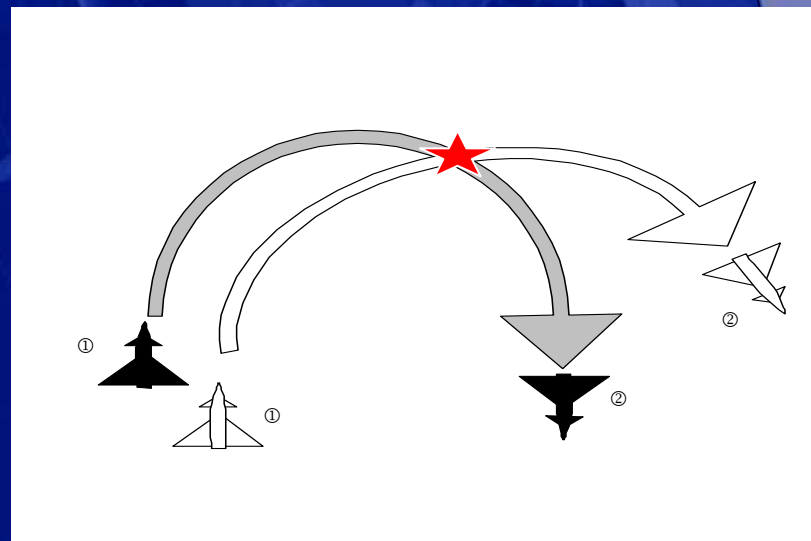
AoA / nz (vertical)

Flight Manoeuvres 2



AoA / nz (horizontal)

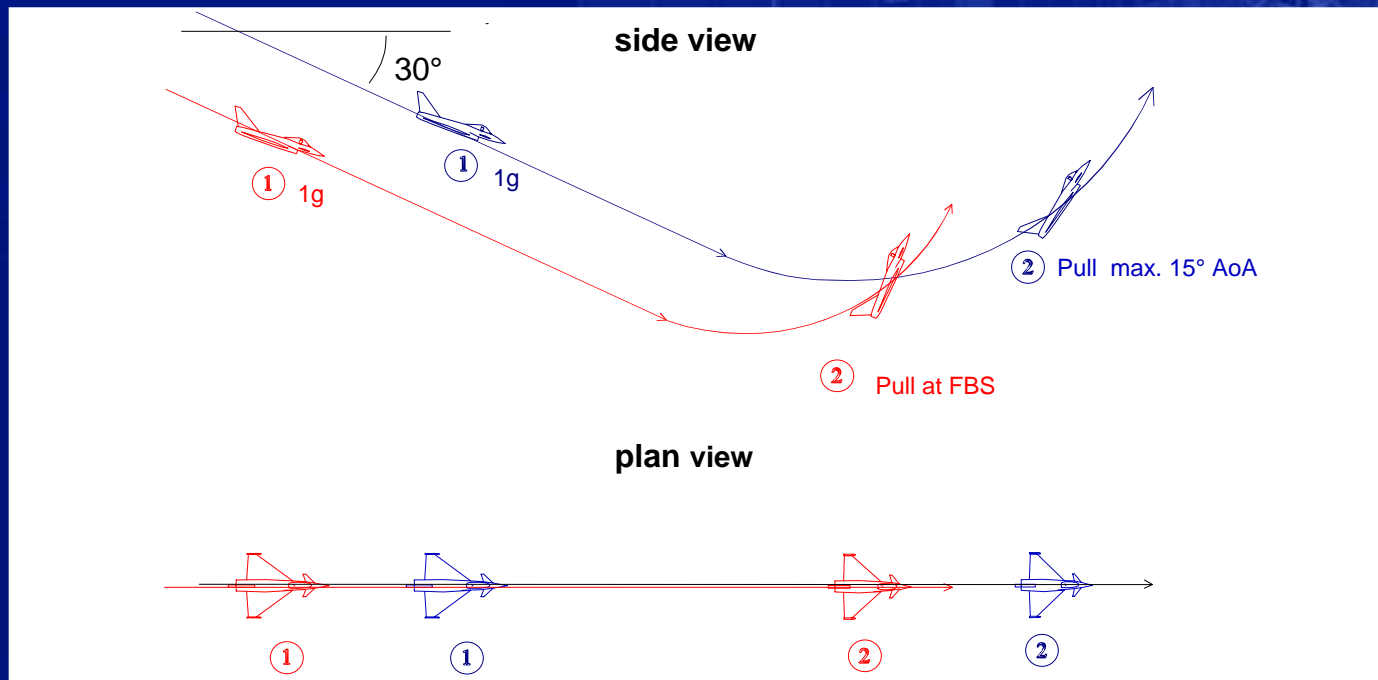
Horizontal crossing in g-turn



Flight Manoeuvres 3

- Vertical Crossing
- Distance to lead A/C at wake penetration 1500 ft

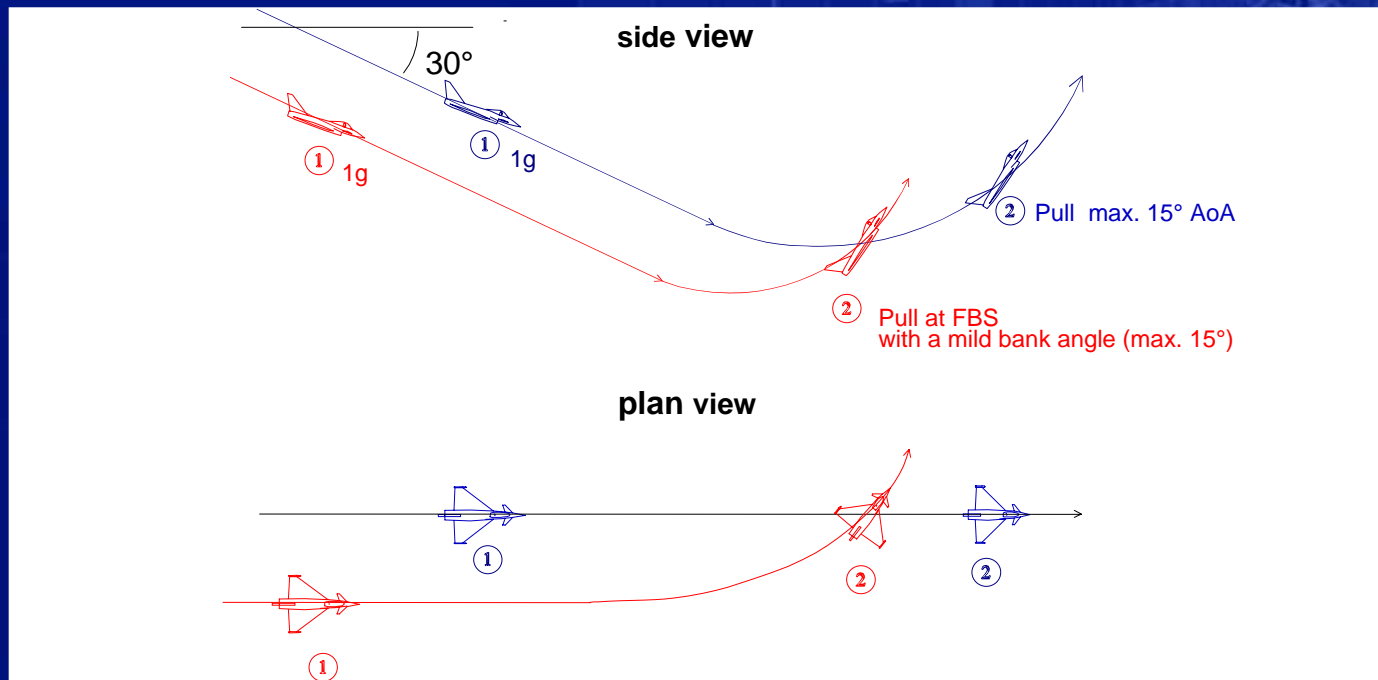
Lead A/C	Test A/C
260 KDAS, 10°/15°	260 KDAS, FBS



Flight Manoeuvres 4

- Vertical Crossing (with horizontal offset)
- Distance to lead A/C at wake penetration 1500 ft

Lead A/C	Test A/C
260 KDAS, 10°/15°	260 KDAS, FBS

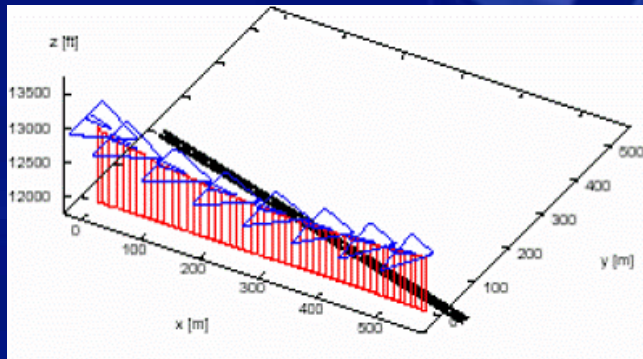


Inflight Experience



Test Results

- Good matching of wake model and flight test



- Robustness of FCS during wake penetration confirmed
- Local structural vibrations on control surfaces within clearance boundaries

