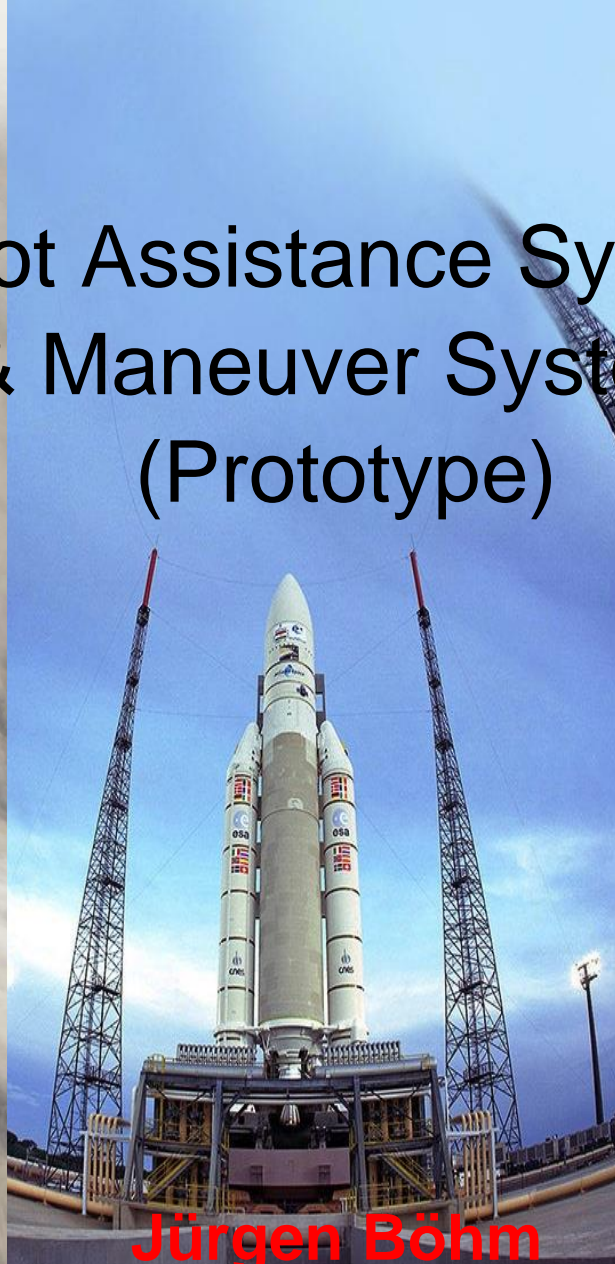


Pilot Assistance System Attack & Maneuver System (AMS) (Prototype)



Mai 2015
Florian Grassel



Jürgen Böhm

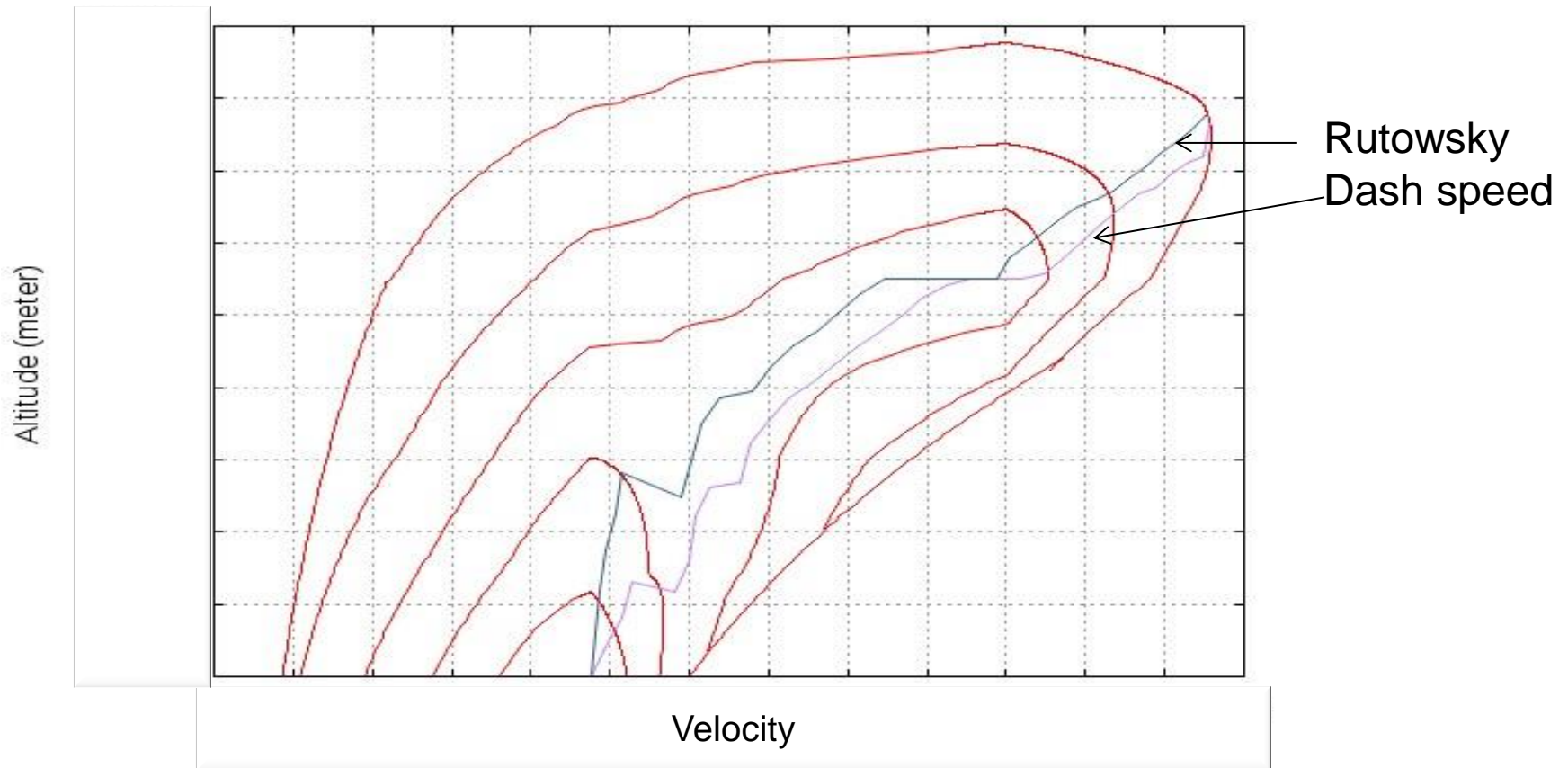


Martin Grieb

Modern weaponsystems consist of many complex subsystems.
To optimize mission-efficiency all components have to be
considered and optimized as a *holistic* weaponsystem

Modern weaponsystems consist of many complex subsystems. To optimize mission-efficiency all components have to be considered and optimized as a holistic weaponsystem

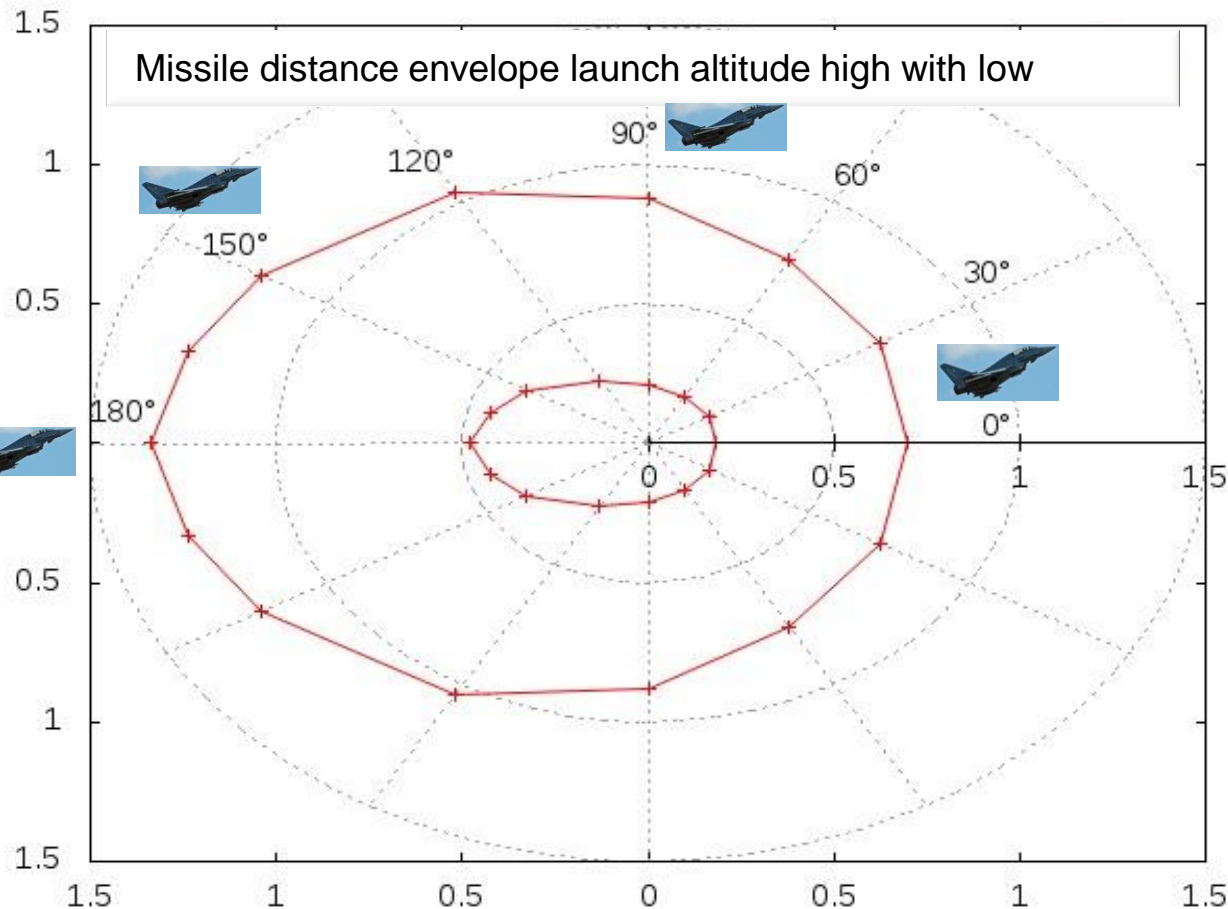
- A/C Flight Envelope



Envelope of a generic Fighters with one definite configuration and weight

Modern weapons systems consist of many complex subsystems. To optimize mission-efficiency all components have to be considered and optimized as a *holistic* weapons system

- Weapon (Missile Air to Air {Missile Envelopes} and / or Surface to Air})



Weapon Distance =
function($h_t, h_l, v_t, v_l, o_t a$)

Modern weaponsystems consist of many complex subsystems. To optimize mission-efficiency all components have to be considered and optimized as a *holistic* weaponsystem

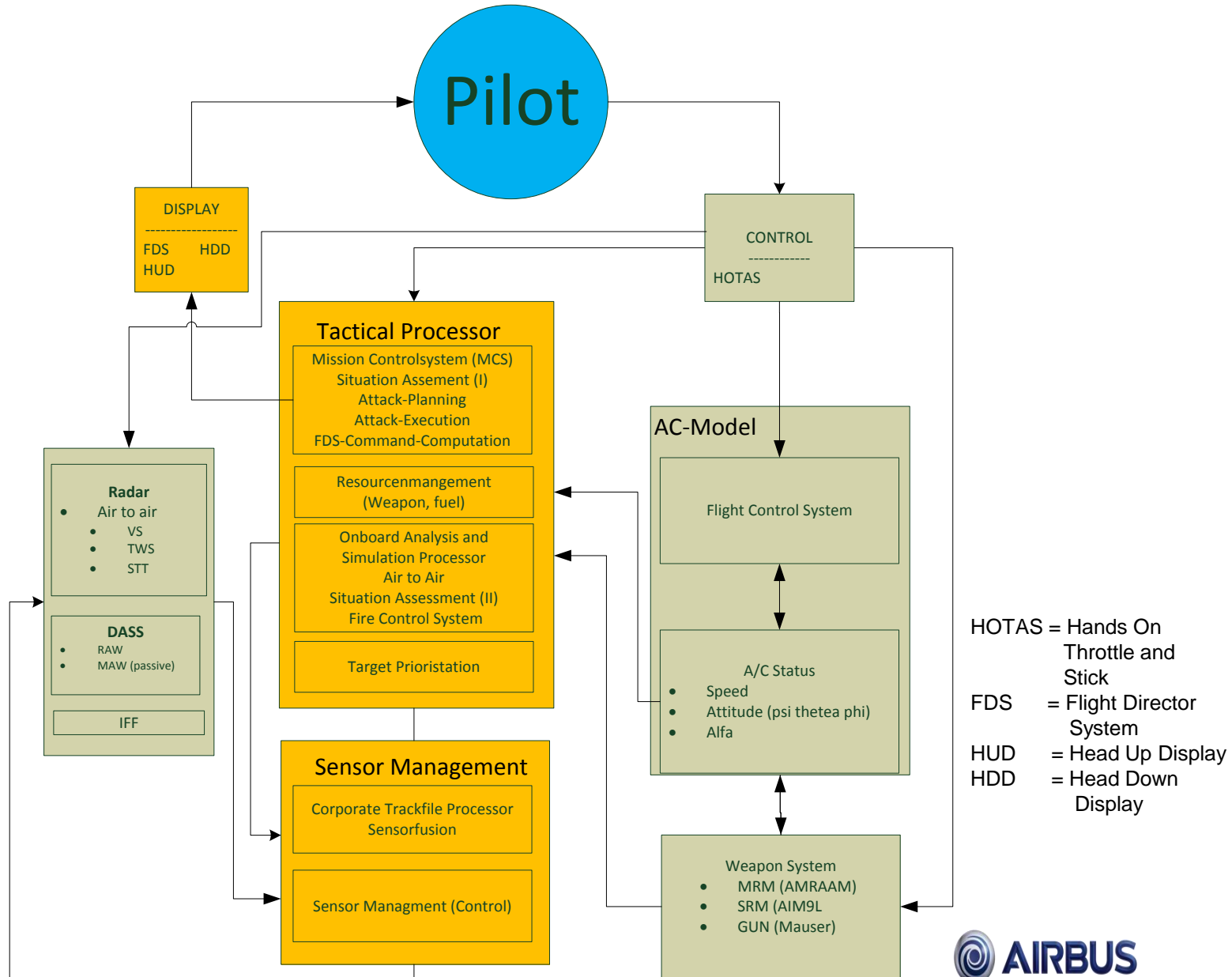
- Radarsignature
- Infraredsignature
- Radar (Moding {TWS, STT, VS ..}, Scancontrol {Direction, Bar, Azimuth}...)
- Defensive Aids Sub System (DASS)
 - Radar Home and Warning System (RHAW)
 - Missile Approach Warner (MAW) (active, passive)
 - ECM (Chaff, Flare, Jammer, Towed Decoy, DIRCM ..)
- Electro-Optical / Infrared Sensors
- External Information
 - Link 16 (Multifunctional Information Distribution System)
 - Ground Control Intercept (GCI)
 - Satellite Picture
 -
- Ground Threats (Surface to Air Missiles, Manpad)

DIRCM = Directional Infrared Counter Measures ESM; ECM = Electronic Counter Measure; VS = Velocity Search;
TWS = Track While Search; STT = Single Target Track

Modern weaponsystems consist of many complex subsystems. To optimize mission-efficiency to consider the subsystems and optimized as a *holistic* weaponsystem

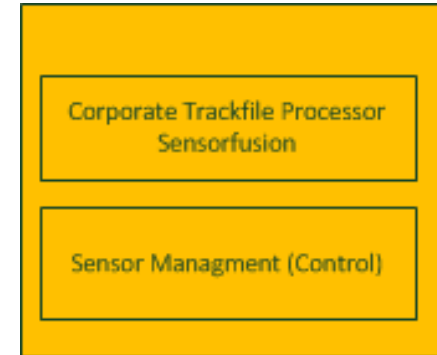
Pilot Assistance System

Attack & Maneuver System (AMS)



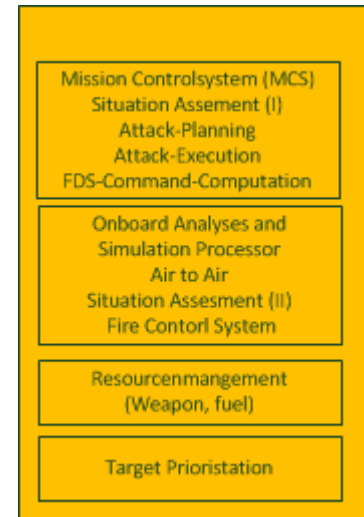
Sensor-Management Module

- Sensor Control
 - Radar Control
 - Mutual assistance with the Tactical Module
 - Search maneuver
 - Offensive maneuver
 - Defensive maneuver
- Automatic re-detection of lost or extrapolated targets
- Corporate Trackfile
 - Combine all sensor information in one trackfile
 - Extrapolate tracks
 - Timely deleting of false targets



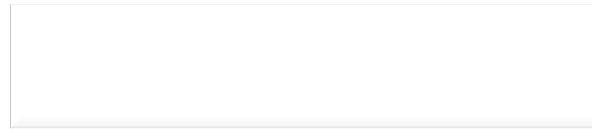
Tactic Module

- Target Prioritization
 - Target selection
- Resource Management
 - Control of fuel,
 - Weapon, chaff, ...
- Onboard Analysis
 - Situation Awareness
 - Dynamic Threat Analysis
 - Offensive
 - Time to Fire
 - Time to Guide, Kill Probability
 - Defensive
 - Safetime
- Mission Control System
 - Mission / Attack planning
 - Mission execution



Pilot-Interface

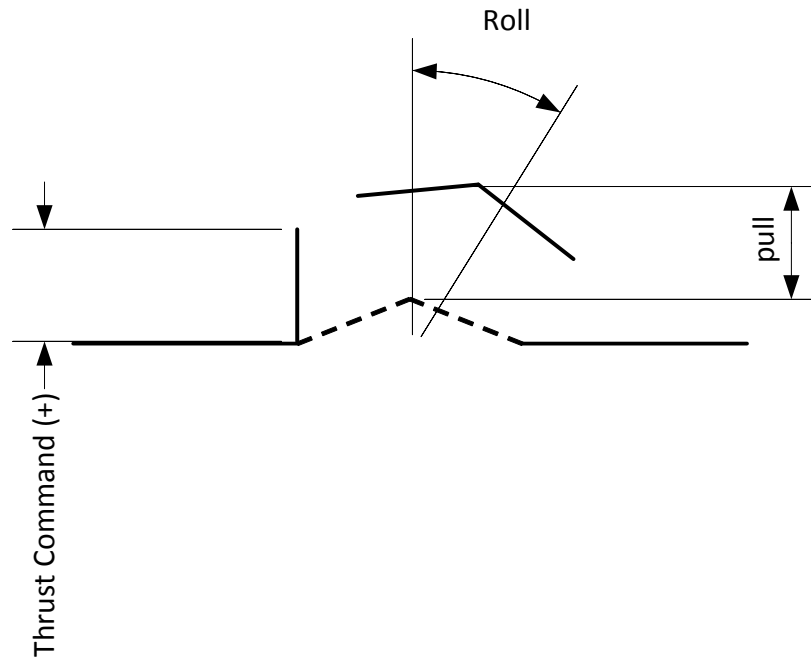
Flight Director System



DISPLAY

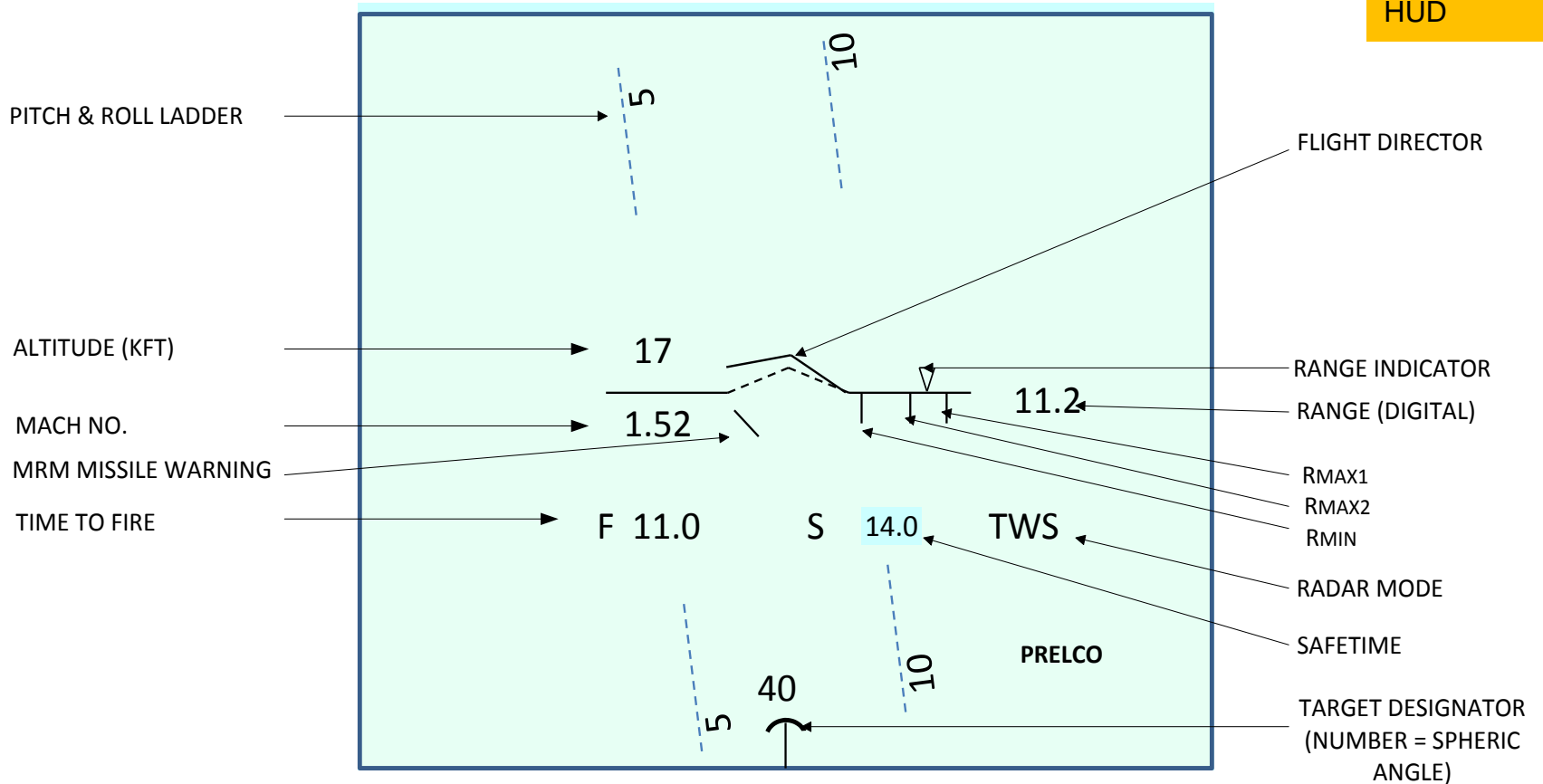
FDS HDD

HUD



Pilot-Interface Head Up Display

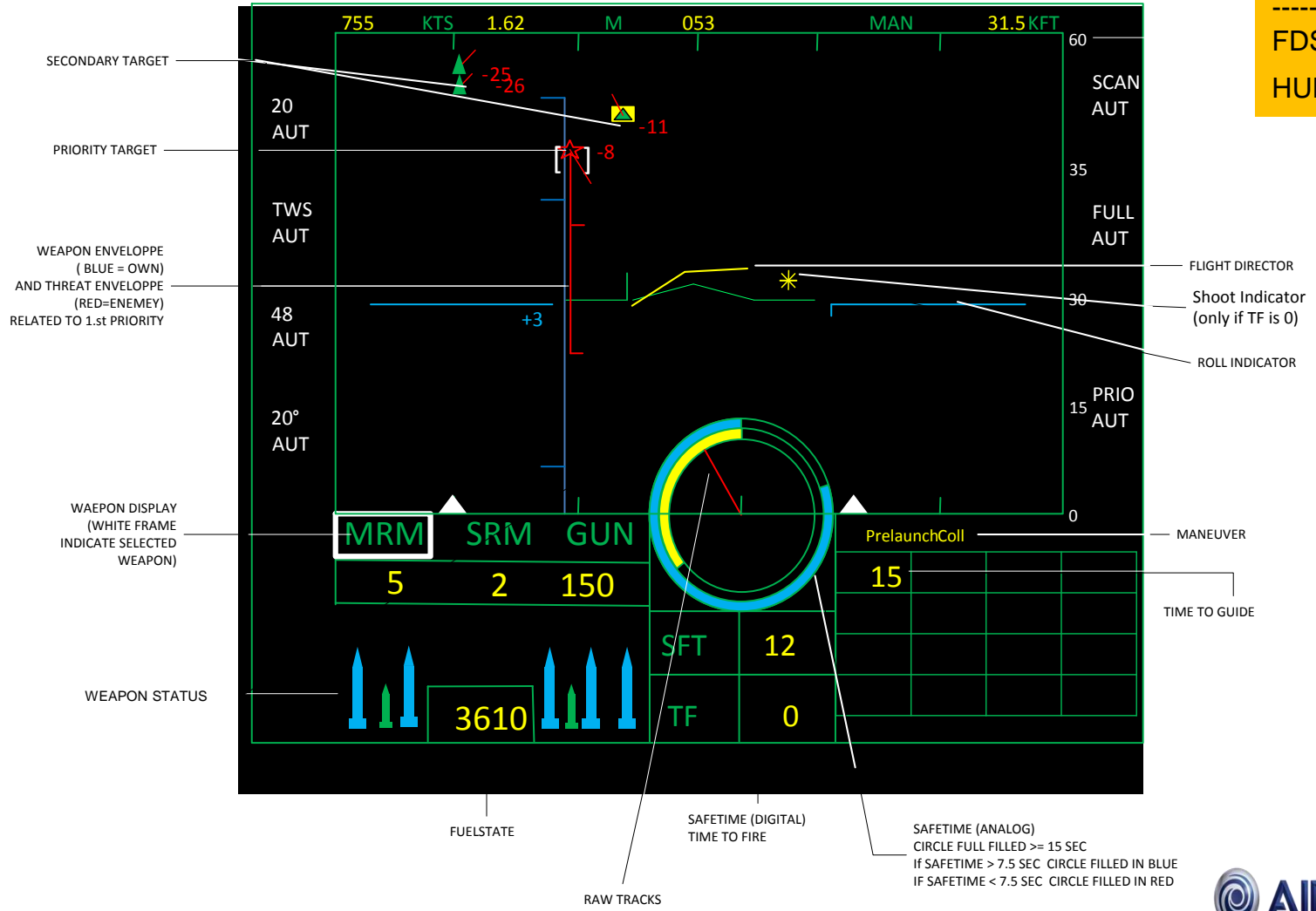
DISPLAY	
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FDS	HDD
HUD	



Pilot-Interface

DISPLAY

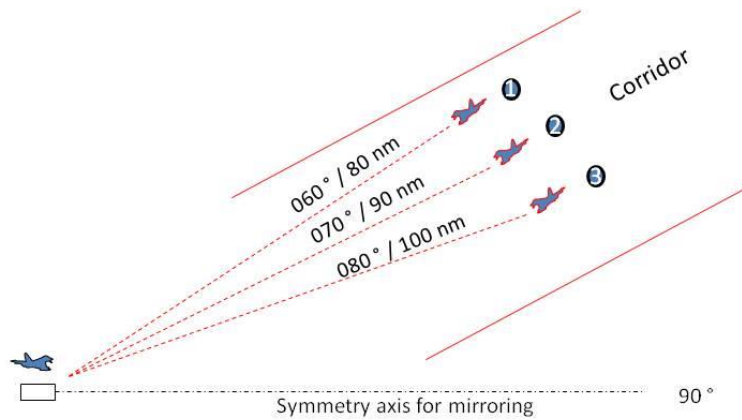
FDS HDD
HUD



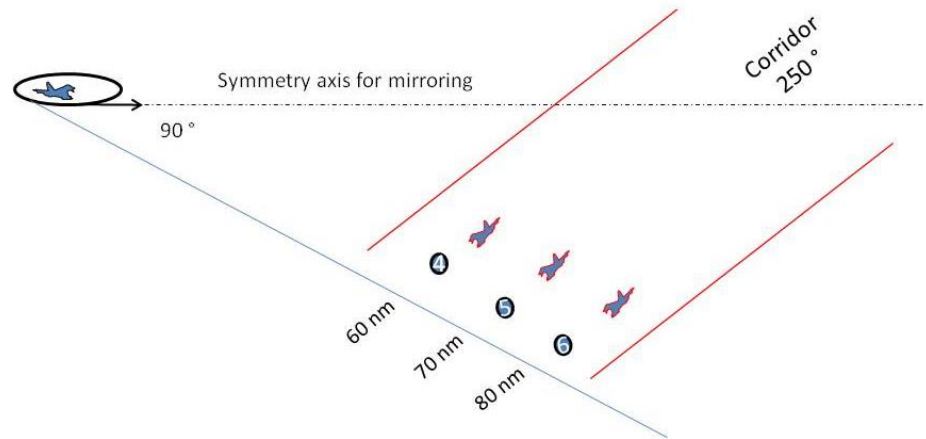
AMS Evaluation



Simulation Evaluation Setup



Start Condition	Blue AC		Red AC		
	Altitude feet	Speed ktn	Altitude feet	Speed mach	Heading
1	0 (500)	0 (250)	5000	0,95	250 °
2	1 (500)	1 (250)	20000	1,2	250 °
3	2 (500)	2 (250)	10000	0,95	250 °



Start Condition	Blue AC		Red AC		
	Altitude feet	Speed ktn	Altitude feet	Speed mach	Heading
4	20000	0,8	5000	0,95	250 °
5	20000	0,8	20000	1,2	250 °
6	20000	0,8	10000	0,95	250 °

Evaluation Results – Parametric Analysis



Case		remark	exchange ratio		Improvement
			red	blue	
1	1 interceptor vs 1 fighter	Reference Case	1	0,7	
2	1 interceptor vs 1 fighter	with AMS	1	1,89	2,7
3	1 interceptor vs 1 escort + 2 Fighter bomber	Reference case	1	0,26	
4	1 interceptor vs 1 escort + 2 Fighter bomber	with AMS	1	1,47	5,7

Pilot : 4 active GAF-Pilots
> 400 Simulation runs

Evaluation Results - Pilot Judgment

- Reduced pilot workload
- Improved Situation Awareness
- Reduced „instantaneous“ n_z
- Consider AC specific „sustained“ n_z
- Good offensive and defensive maneuver proposals, based at good assessment of the red fighter potential



Summary

To optimize mission-efficiency all components have to be considered and optimized as a *holistic* weaponsystem

- Improved Situation Awareness
- Reduced pilot workload
- Reduced „instantaneous“ n_z
- Improvement of the mission-efficiency by factor $> 2.7 - 5.7$
- Further improvement potential by extension of the modules