

JANUS

High-Energy Supersonic & Low-Cost Aircraft

- Advanced Trainer
- Red-Air/Opponent Simulation
- Support Missions

$$C_D = C_{D_0}(Mach, H) + C_{D_i}(C_L, C_{L_{min}}, Mach)$$

$$C_D = n_{drag} \left[\underbrace{C_{D_0}(M, h) + C_{D_i}(C_L, C_{L_{min}}, M)}_{\text{aerodynamic}} + \sum_{storage} \frac{\Delta S_{storage}(M)}{S_{ref}} + \frac{\Delta S_{Dgear}}{S_{ref}} \right]$$

$$D = \frac{\rho}{2} v^2 C_D S_{ref}$$

$$n = \sqrt{\frac{(v_{rate})^2}{g} - 1}$$

$$m\dot{v} + D - T \cos(\alpha + \sigma) + mg \sin(\gamma) = 0$$

$$-m v \dot{\gamma} + L - T \sin(\alpha + \sigma) - mg \cos(\gamma) = 0$$

Dr. Georges Bridel

Managing Director ALR Aerospace

SMI Military Flight Training Conference

21 - 22 SEPTEMBER 2016, LONDON, UK



Dr. Georges Bridel

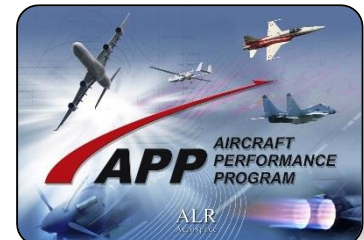
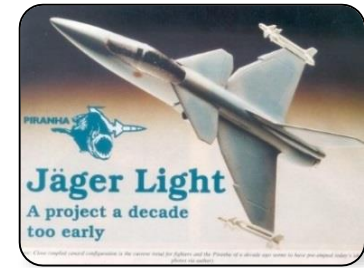
Since 2011 ALR: Managing Director

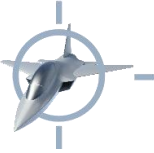
1993-2010 Airbus: VP Future Military Air Systems

- DASA Ranger 2000 FSD Project Lead
- Concept developments: advanced trainer a/c, unmanned air systems, stealth a/c, tools, technology strategy, operational analysis

1978–1993 ALR: Full Scale & Concept Developments

- Piranha²) Fighter Concept with Boeing (1981-1984)
- The HAL-Tejas LCA concept, won by MBB with participation of ALR (1984)
- FFA 2000 Eurotrainer (1985-1989)
- Development APPTM aircraft performance program





Advanced Training for Today's Air Forces

Cost



Current Training Aircraft

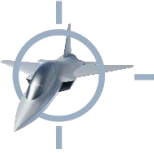
- Face Replacement
- Lack Overall Performance
- Training-Use Only

Current Fighters Require

- High Performance Trainer
- Equivalent „Red-Air“ & Opponent Simulation

Current Solution: Legacy Aircraft

- Use of Outdated Systems
- Reaching End-of-Life
- High Cost of Ownership
- Expensive Tactical Combat Training Program (TCTP)



ALR's Solution – JANUS

“The integrated approach of mission analysis combined with application of advanced technologies“



✓ **High Energy**
close to operational fighters

✓ **Supersonic**
to match AT, Red-Air and air policing requirements

✓ **Small and Light**
strict requirements management, low-cost
powerplant & equipment

✓ **Mission Equipment**
on ground, operated via datalink

✓ **Low Cost**
the key benefit!

JANUS Concept – The Basics

Advanced Training (airborne element)

- High energy and reheat management
- Fighter-like manoeuvrability, SEP++
- Supersonic speed $M=1.3+$
- Tight mission sequences and timelines
- Handling qualities
- Embedded simulation equipment datalink

Support Missions

- Simulation of opponents, „Red-Air“
- Armed air policing (with a gun pod), unarmed vs. „cooperative“ targets
- Air-tactics experimental, operational incl. technology developments
- Unmanned high-performance simulations

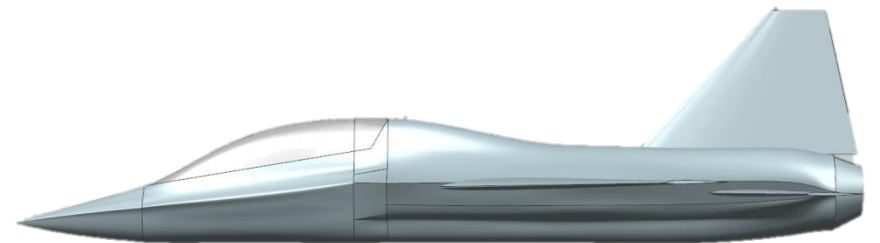
Requirements

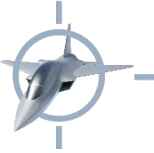
Design base for JANUS:

- Max. sustained g-load of 6.5 g at 10 kft, 80% internal fuel (T-X)
- Ferry mission requirement of 2000km (EURAC)
- Supersonic speed $M 1.3$ at altitude (Advanced Training, „Red-Air“ and Air Policing)
- Minimum on-board equipment

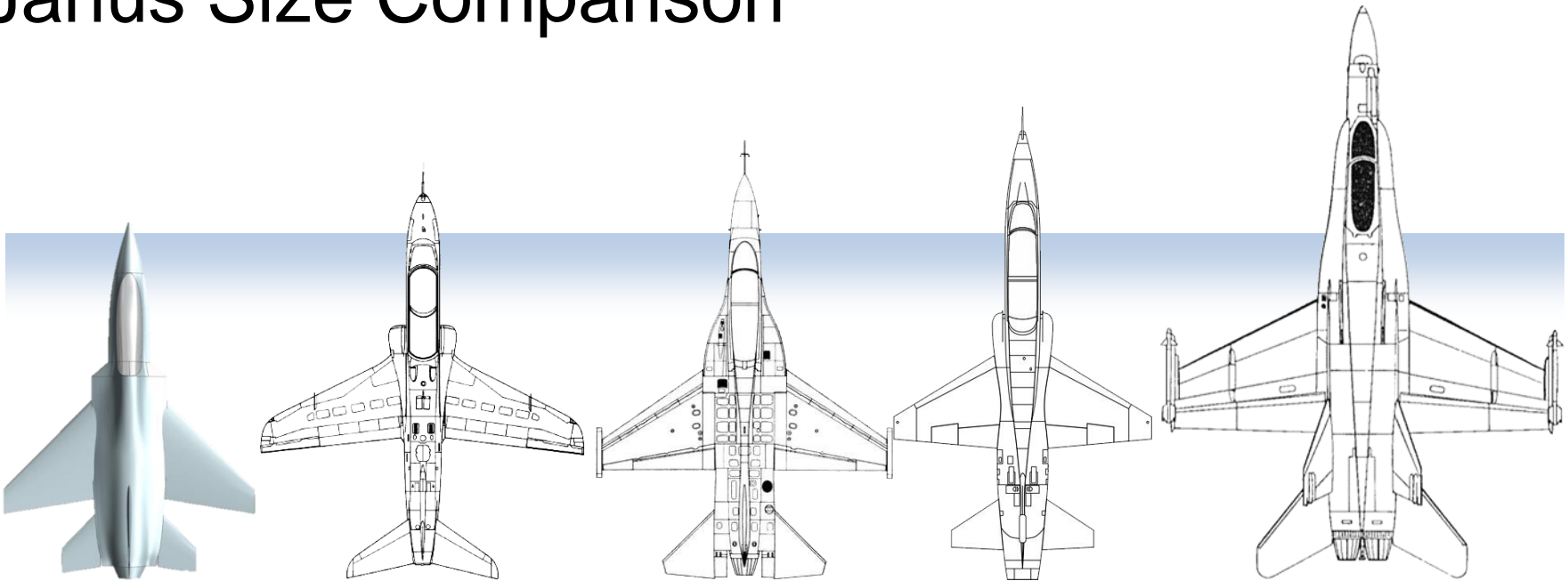
JANUS Aircraft Concept: Schematic Three-View

Description	Unit	Dimension
Length	m	11.00
Wingspan	m	8.00
Clean Takeoff Weight	kg	4'800
Wing Area	m ²	18.00
Max Reheat Thrust	kN	42-45
Max. Mach	[-]	M > 1.3
Composite Fraction	[%]	50





Janus Size Comparison



	AT Janus	BAE Hawk Mk 65	T-50 Golden Eagle	T-38A Talon	F/A-18C/D
Length	11 m	12.4 m	13.1 m	14.1 m	17.1 m
Area	18 m ²	16.7 m ²	23.7 m ²	15.8 m ²	38 m ²

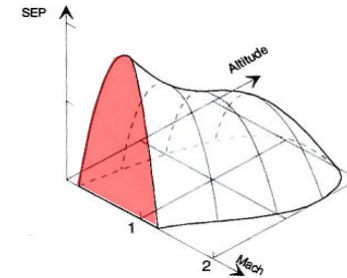
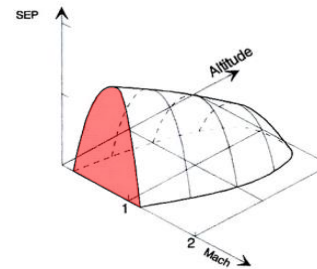
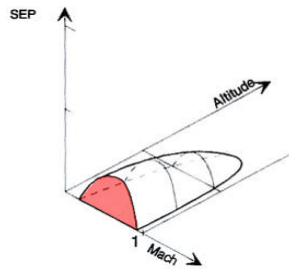
Small Size and Low Weight Means Low Cost!

Why “JANUS” High-Energy Advanced Trainer ?

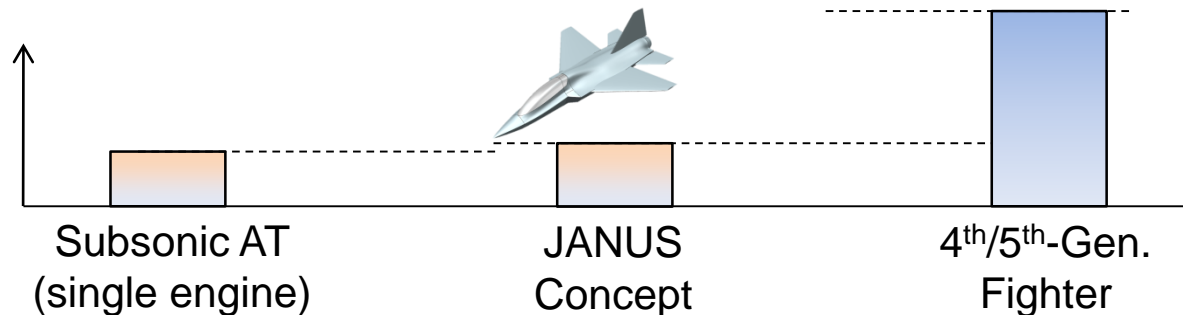
- Energy & Manoeuvrability close to operational aircraft, the volume shows the energy in terms of SEP (vertical) over Mach and altitude (plane)
- Generic cost relations are extremely advantageous for JANUS
- Dedicated design, no armament and related avionics

Energy Envelope (SEP / Altitude / Mach)

(SEP / Altitude / Mach)



Cost (per flight hour)

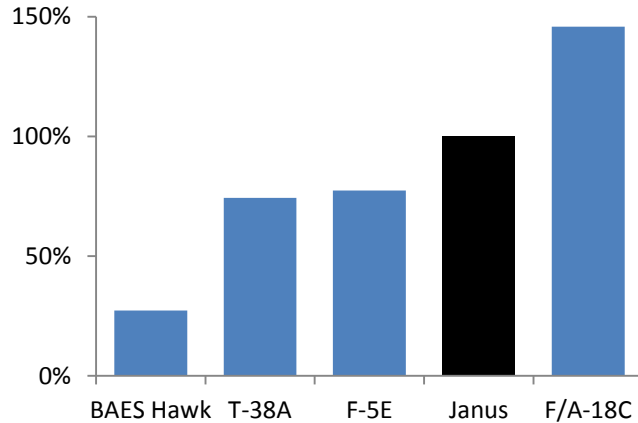


High Performance and High Energy at very low Cost

Key Performance Data

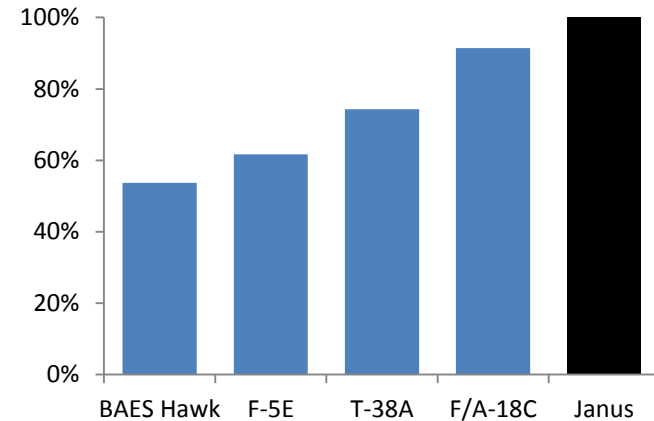
Max. SEP Comparison

(at 10 kft, 50% fuel, reheat where applicable)

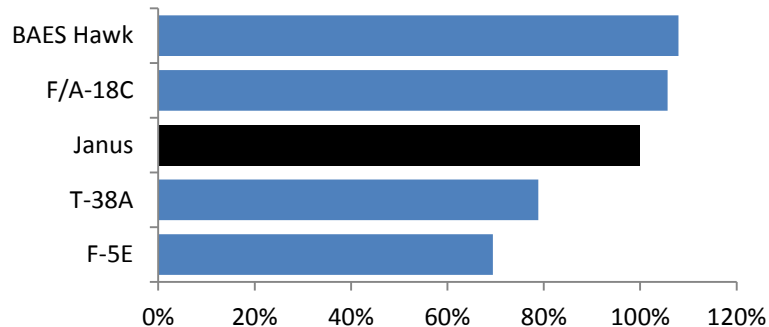


Max. Sustained Loadfactor

(at 10 kft, 50% fuel, reheat where applicable)



Ferry Range (no external tanks)

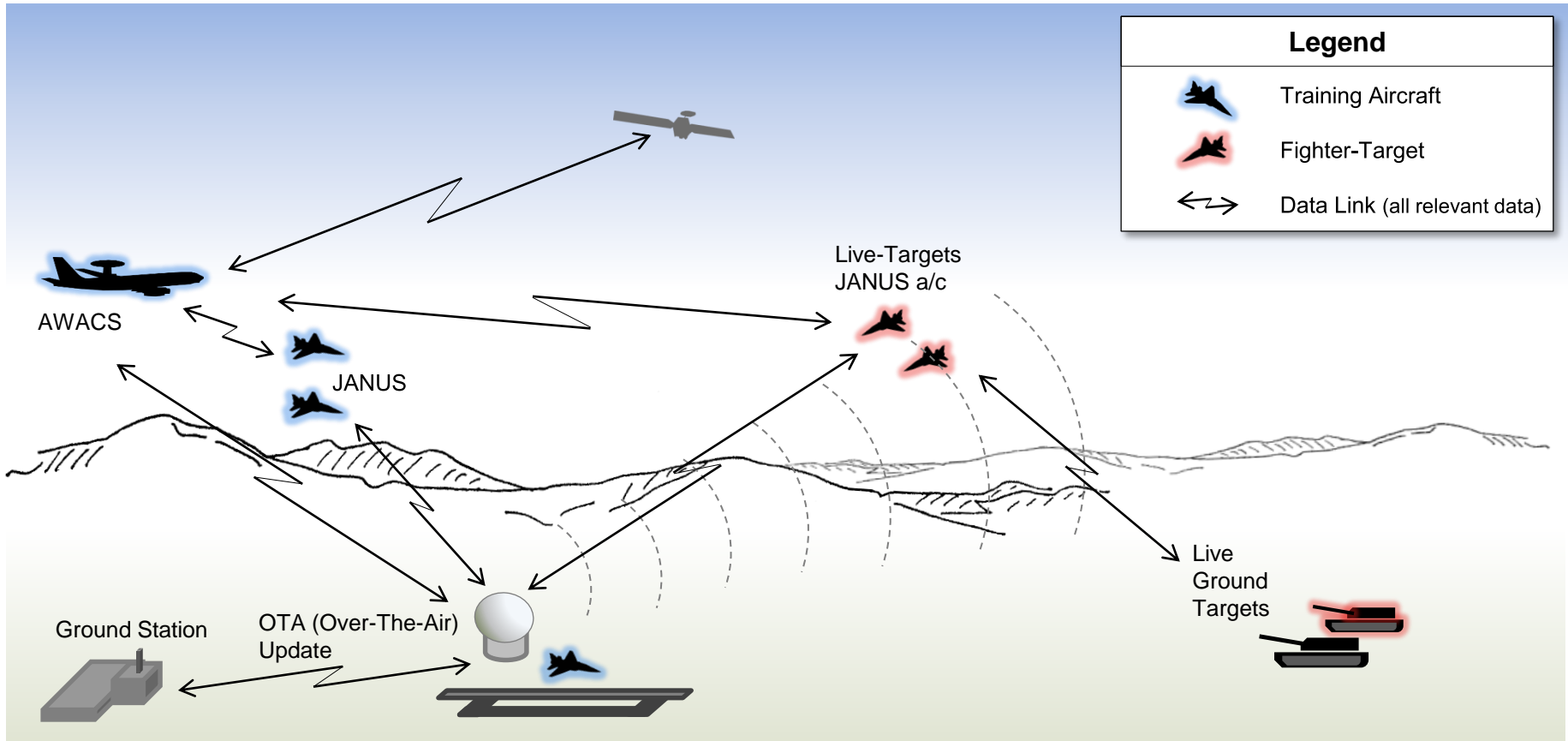


- ✓ High Performance Red-Air Aircraft
- ✓ EURAC³⁾ air combat mission
- ✓ Undergraduate Pilot Training Missions⁴⁾
- ✓ Fighter Fundamentals Training Missions⁴⁾

Provided data depending on assumptions and conditions.
 3) EURAC - European Air Chief Conference
 4) Equivalent to T-X Requirements

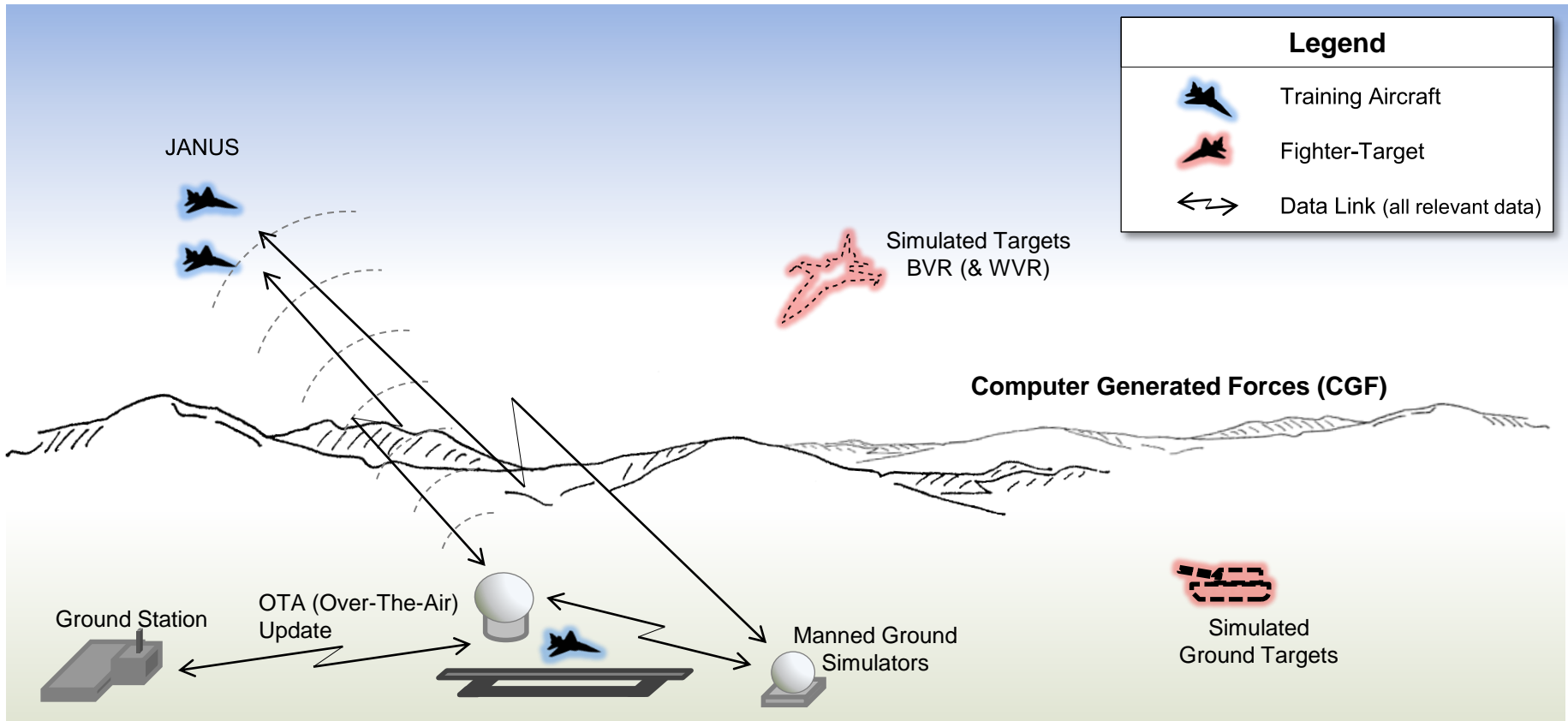
Air Combat & Ground Attack Training (1)

- Energy & Manoeuvrability close to operational fighters
- Real JANUS aircraft to represent operational fighters **and** opponents



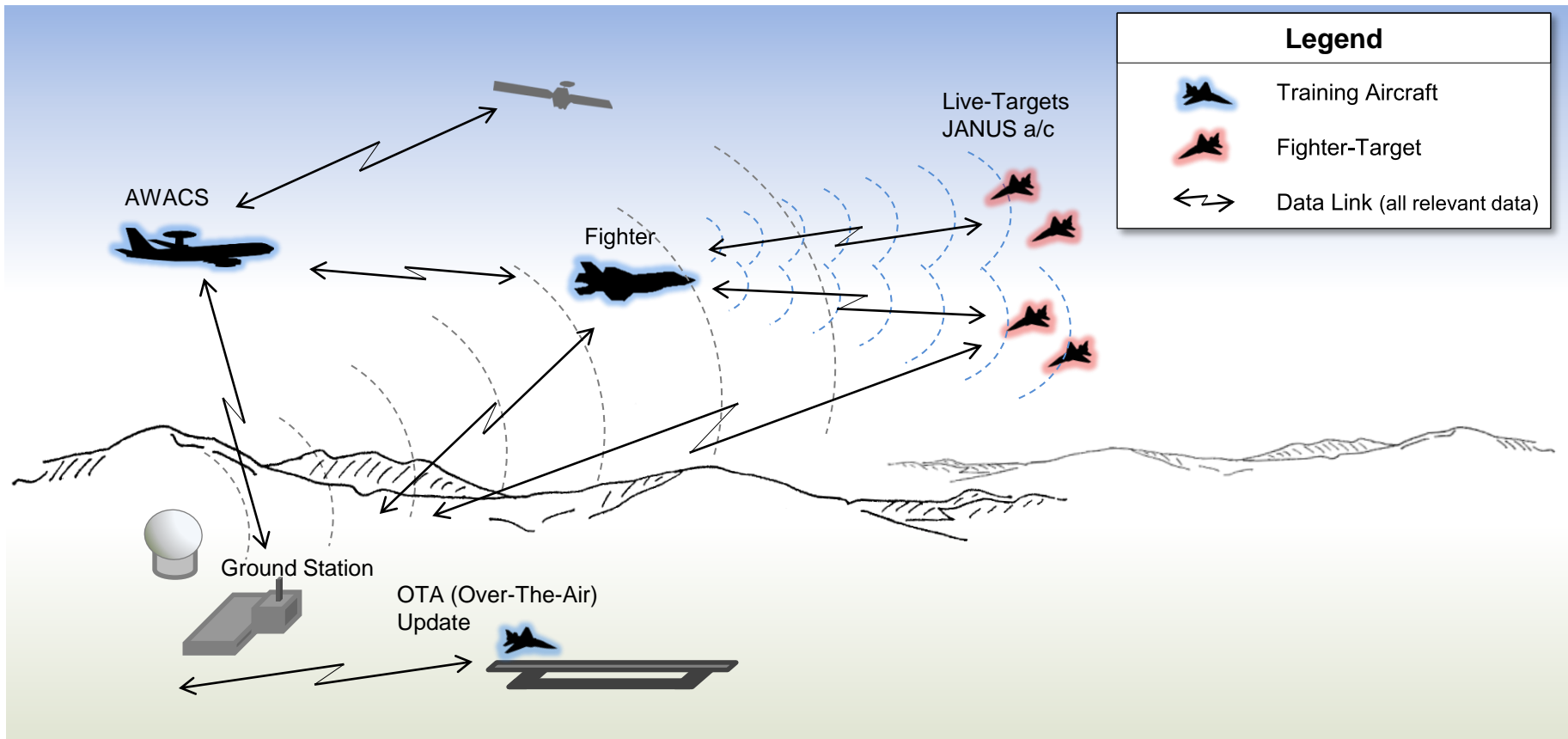
Air Combat & Ground Attack Training (2)

- JANUS aircraft vs. simulated targets
- Target simulation embedded or via datalink
- Manned Ground Simulators



“Red Air” Operational Fighter Training

- Multiple JANUS aircraft in the air (against 5th gen., e.g. F-22, F-35)
- 5th generation fighters need **multiple real targets (cost!)**



Today's „Red Air“ Solutions

Legacy and old aircraft, or..



...front-line combat aircraft

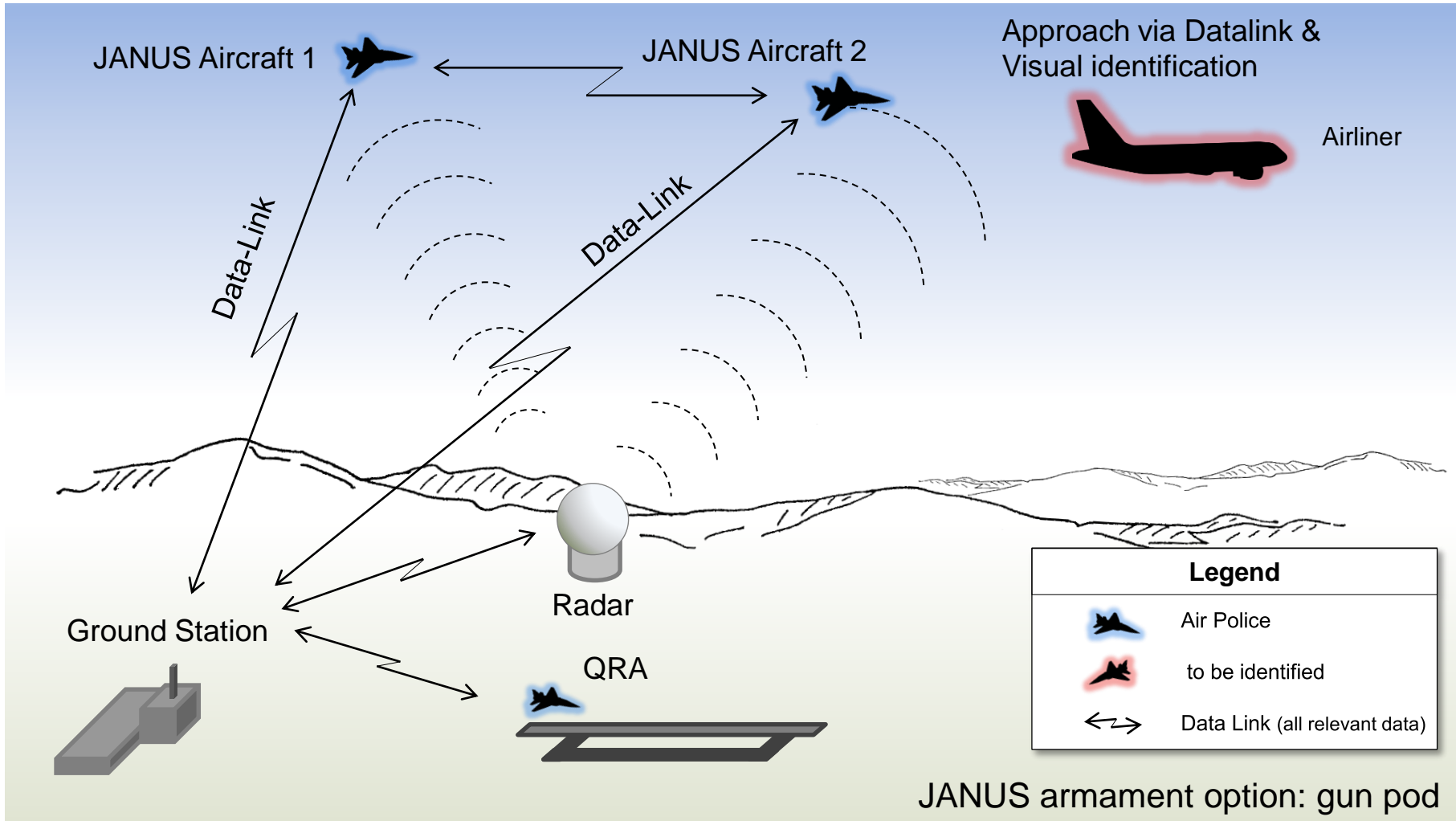


- More than 150 aircraft in use worldwide, also by civil operators (ATAC, Discovery Air, Draken,)
- Mis-use of combat force at high cost!

It is Time for a Dedicated Aircraft!

Operational: Air Policing

(live operations: “non-combat” or for training)



JANUS

Conceptual Reference



The air vehicle, „the body“:

- High energy (SEP, Turn-Rate)
- Two seat, IFR cockpit
- Minimum airframe and powerplant
- On-board mission equipment only where not met by datalink-capabilities
- Structure: 50% composite material
- „Minimum cost“ as prime target in procurement and operation

Pilot and avionics, „the mind“:

- Integrated „man-machine“ like combat a/c, but simulated, advanced technologies
- Mission relevant capabilities: provided via datalink(s) from:
 - External: ground, AWACS, fighters, or
 - „on-board“ simulations
- Technology developments: operational test-bed for optionally piloted high performance UCAVs

Thank you for your attention



www.alr-aerospace.ch

Backup

$$C_D = C_{D0}(Mach, H) + C_{DF}(C_L - C_{L0}, Mach)$$

$$e = \frac{(C_L - C_{L0})^2}{\pi \lambda C_{DF}}$$

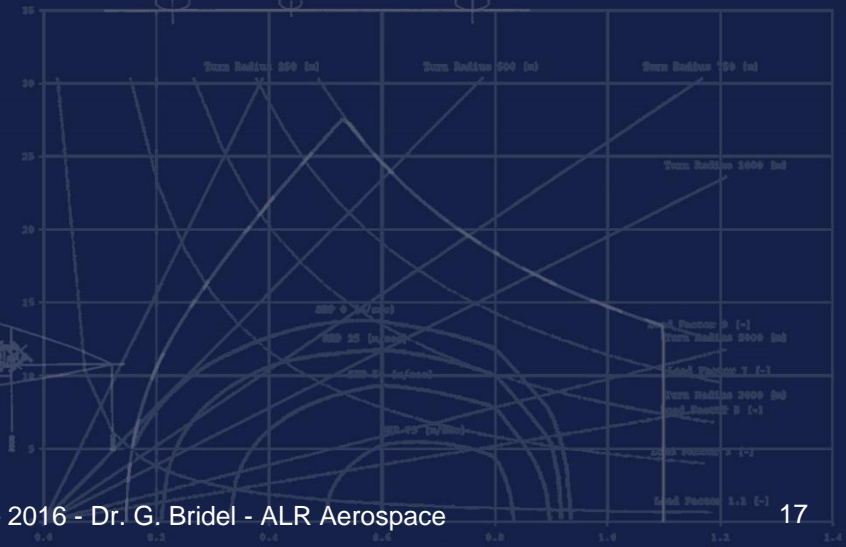
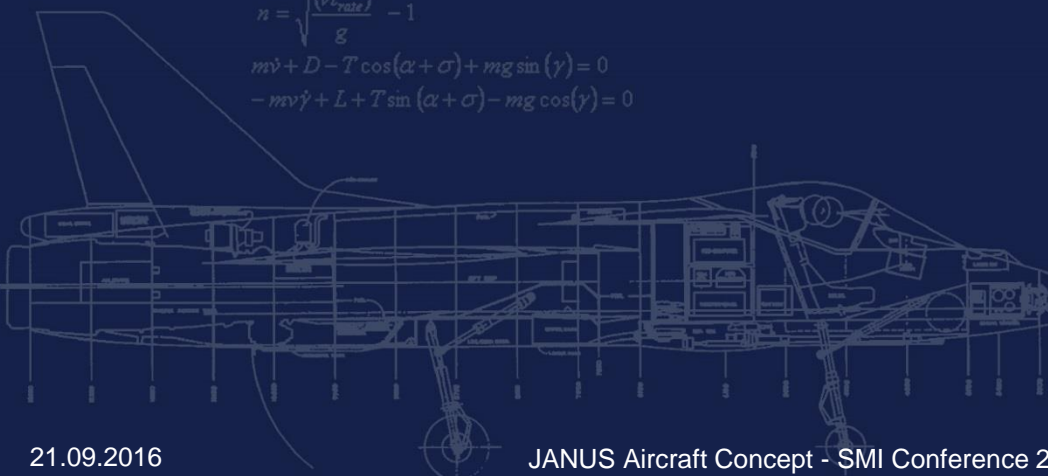
$$C_D = n_{drag} \left[\underbrace{C_{D0}(M, h) + C_{DF}(C_L - C_{Lmin}, M)}_{aerodynamicfile} + \sum_{storagist} \frac{\Delta S_{storage}(M)}{S_{ref}^{storage}} + \frac{\Delta S_{Dgear}}{S_{ref}^{configfile}} + \frac{\Delta S_{drag}}{S_{ref}^{configfile}} \right]$$

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Press and Web

- Corriere del Ticino - March 30 2016
• AVIATION WEEK - May 11 2016

http://aviationweek.com/defense/multimission-concept-lightweight-advanced-trainers



ALR's Janus is a lightweight, single-engine advanced trainer that could also perform limited air policing duties.

Independent Ideas

Could ALR's Janus concept find a future in the inventory of the world's air arms?

Tony Osborne London

A Switzerland-based team of aircraft designers and engineers believes that a lightweight supersonic advanced trainer and multi-mission aircraft could be appealing to air arms investing in a new generation of combat aircraft...

previous work includes a 1970s study on Piranha—a lightweight canard delta microfighter designed to meet the needs of small nations looking to replace the F-5 Tiger and the Mikoyan MiG-21...

In part, Janus came about because of Switzerland's woes with procurement plans to replace its fleet of Northrop F-5 Tigers. A referendum in May 2014 rejected the purchase of the Saab Gripen in spite of the fact that just weeks before, the Swiss air force was unable to respond to a hijacked Ethiopian airliner landing in Geneva...

Another potential market is the increasing number of private companies that operate ex-military aircraft to service military training contracts. Aircraft in use include the A-1 Skyhawk, Dassault Alpha and Hawk Hunter...

required. This consumes airframe flight hours at a high price and leads to a waste of resources... The organization states, 'Janus would be a fly-by-wire 4,800-kg (10,500-lb) mid-sweep-wing monoplaner powered by a single turbojet...

Ukrainian Ilyushin Progress ALR-22Z, the Honeywell TFE731 turbojet and the Japanese IHI Corp. XF5, which is the engine fitted to the X-2 demonstrator aircraft.

Supersonic capability is 'essential' for the air policing mission, says Group Capt. (ret.) David Hamilton, who has consulted on what the air force requirements might be for such a role. Air policing missions regularly have to intercept airliners traveling at high subsonic speeds...

As a trainer, the aircraft would have an advanced two-seat cockpit with simulated stores and radar. ALR believes that a live, virtual constructive training system could be implemented to control the airiner down. ALR believes that a live, virtual constructive training system could be implemented to control the airiner down...

creditability given the teta dello spazio zero e la ricerca di nuove tecnologie... ALR crede che un velivolo di questo tipo potrebbe essere la soluzione migliore per sostituire i velivoli di questa generazione...

PRIMO PIANO

Prospettive
Quale aereo per la Svizzera? È ora di ricominciare da tre

Bocciato l'acquisto del Gripen il nostro esercito rimane alla ricerca di un velivolo in attesa di quella che potrebbe essere l'ultima generazione di apparecchi pilotati



La Svizzera è un paese che ha una lunga tradizione di alti standard di qualità... L'acquisto di un nuovo velivolo è una decisione che deve essere presa con cautela...

Il nuovo velivolo deve essere in grado di svolgere missioni di combattimento e di addestramento... Deve essere in grado di operare in condizioni di alta quota...

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