DLR Institute of Flight Systems

On-going Efforts and New Projects

SAE AGCSC Meeting #97

Dr. Frank Thielecke, Joerg Dittrich
Inflight-Wake-Vortex-Simulation

- IFS preparation: Instrumentation, Modelling, HITL-Simulation
Electronic Flight Control System Rig (EFCS)

- Hard real-time closed-loop-simulation (dSpace)
- Completion of a 5000 psi hydraulics system
- Various control surfaces have been connected

2006 Implementation of an Airbus-type FCS
2006 Setup of a dynamic loads simulation
2006 Completion of the initial setup of the EFCS-Rig facility
New Flight Control Concepts - Blended Wing Body

- Conceptual analysis of flight control concepts
- Controller synthesis, primarily for stabilisation
- Stability- and controllability analysis

2006 Pilot-in-the-Loop Simulations using the EFCS-Rig
2006 Knowledge transfer to EU-Project NACRE

PoC: Mr. Aitor Iniguez
Active Control Inputs / Cargo Handling

Active Side Sticks for the FHS Helicopter
- Conception, Selection & Purchase of a right hand side stick
- Integration design and construction

2006++:
- Integration of r.h. side stick,
- Conception and Integration of l.h. side stick
- Realization of basic functionalities
- Mission-oriented evaluation of tactile cueing

Cargo Handling / Slung Load
- Evaluation of a 2-axis display (Flight Director)

2006++: CH 53 flight tests, Extension for vert. axis, Precise Load Positioning

PoC: Mario Hamers
Sidesticks for Helicopters

FHS - Integration
Evaluation Maneuvers for Side Stick Controls

"Pirouette"

Slung Load

Sloped Landing Sites

International Team

PoC: Mario Hamers, Marc Höfinger
**Simulation of Swarming Behavior for UAVs**

- **Old Stuff:**
  - Classical swarming rules with point-mass airplanes
  - Basic Algorithms for trajectory tracking
  - 3D and scalable number of vehicles

- **New stuff:**
  - Still the same rules
  - But: on-going evaluation of the applicability for real aircraft: GARTEUR Workgroup (EU)
  - Simulation with real-world dynamics!
New UAV Helicopter System - maxiARTIS
Specifications - maxiARTIS

Airframe
› Rotor diameter: 3m
› MTOW: 25 kg
› 1 mini turbine, 6 h.p.
› Controllable through safety pilot

Payload
› 4 kg GNC Avionics
› Max 6 kg experimental payload
› Identical payload mounting system to older ARTIS UAV

UAV System is currently undergoing first flight tests

Video
Ground and Ground Effect Modelling for ARTIS UAV Simulation

- Integration of ground interaction forces into the model
- Primary aerodynamic effects in ground vicinity (ground effect)
- Add-On to the ARTIS flight physics model

Video!
Ground Interaction
Ground Effect
Manned-Unmanned Teaming Simulation

Fully coupled Hardware-in-the-Loop simulation environment

FHS Vehicle Simulation

ARTIS Vehicle Simulation

FHS Hardware

ARTIS Hardware

Sim Link Protocol

Video Stream

Command Link