


# MUST

## Multi-UA Supervision Testbed



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## "NLR FACILITATES RESEARCH ON UNMANNED AIRCRAFT SYSTEMS WITH RECONFIGURABLE GENERIC GROUND CONTROL STATION FACILITY"

Remotely controlling a vehicle requires a good Situational Awareness (SA) of the human operator(s) on the ground. The physical gap between the operator and the Unmanned Aircraft (UA) makes it hard to accomplish this task. Unmanned aerospace therefore is prone to human error.

MUST, which stands for Multi-UA Supervision Testbed, is developed by the National Aerospace Laboratory (NLR) as a reconfigurable generic UA Control Station (CS) research simulation facility. The simulator can easily be adjusted to research demands and is used for research on all kinds of human factors. The purpose of this research is to improve human(-machine) performance in order to reduce the human error, so unmanned flight becomes safer and more efficient.



“NLR’S UA CONTROL STATION FACILITY  
COULD MAKE UNMANNED FLIGHT  
SAFER AND MORE EFFICIENT.”

## System Architecture

The architecture of MUST supports control of both operational - and virtual platforms. Operationally it has been deployed as a CS for one of NLR’s research aircrafts (Fairchild Metroliner II) and as a CS for one of NLR’s research quadcopters (Pelican; Ascending Technologies). As a virtual environment MUST is an integral part of the NLR Airpower Simulation capability, whereby all NLR simulators can be flexibly interoperated on demand. In this setting MUST has been deployed in combination with NLR’s Fighter4-Ship. It can also be used in combination with NLR Air Traffic Control Research Simulator (NARSIM) , NLR’s Helicopter Pilot Station (HPS) and NLR’s Video Exploitation System (VES). By means of this flexible connectivity, all kinds of teaming aspects and integration in controlled airspace can be researched with MUST. Because of the standardized Stanag 4586 support it will also be possible to connect to all kinds of external systems.

## Crew concept

An important field of interest for UA systems is crew concept. A first step in reducing the human error in unmanned flight is to optimize the crew of the CS. The MUST facility can be used to research optimal skills and competencies for a UA crew.

Another way of relieving the human operator is to let the system take over some of his tasks; automation. The challenge hereby is to find a good compromise for the level of automation, while keeping the operator “in-the-loop” instead of “on-the-loop”. As MUST can be configured into different levels of automation, MUST is an excellent simulation facility for this type of research.

## Taskload

Human error is closely related to taskload. When taskload is high, humans are vulnerable to errors.

An important way of reducing taskload is to provide the operator with good SA. This is done by providing him with the right information at the right time in the right format. The interface for presenting this information is referred to as Human Machine Interface (HMI). The HMI of MUST can easily be adjusted according to research demands.

Also the type of input device might influence the taskload experience of the human operator while performing his task. MUST can be equipped with different kind of input devices, for example a SpacePilot (3D mouse), multi-touch screens, advanced game controllers or eye trackers.

## Efficiency

A UA commonly is controlled by two operators; the Vehicle Operator and the Payload Operator. Generally a third operator, the so-called Mission Commander is needed for high-level command and decision making. The operator-to-vehicle ratio of a common UA thus is three to one. Reducing the taskload will not only lead to safer operation but can also aid in reducing this operator-to-vehicle ratio, thereby increasing efficiency. Eventually even the simultaneous control of multiple UAs could be made possible. MUST supports simultaneous control of multiple UAs and can therefore be used to find relations between taskload and efficiency.

## Features

- Supports both operational - and virtual platforms
- Supports both operational - and virtual video images
- Supports a wide range of UA types, from small to MALE/HALE
- Supports Stanag 4586
- Platform control:
  - Auto-Pilot control
  - Waypoint control
- Camera control:
  - Manual control
  - Geo-referenced control
- Preflight planning (checked against fuel, terrain, traffic)
- Reconfigurable GUI, both PC and tablet based
- OSG based map engine
- Supports ADEXP traffic information
- Logging functionality
- Parts of the system developed within AT-One in co-operation with DLR

