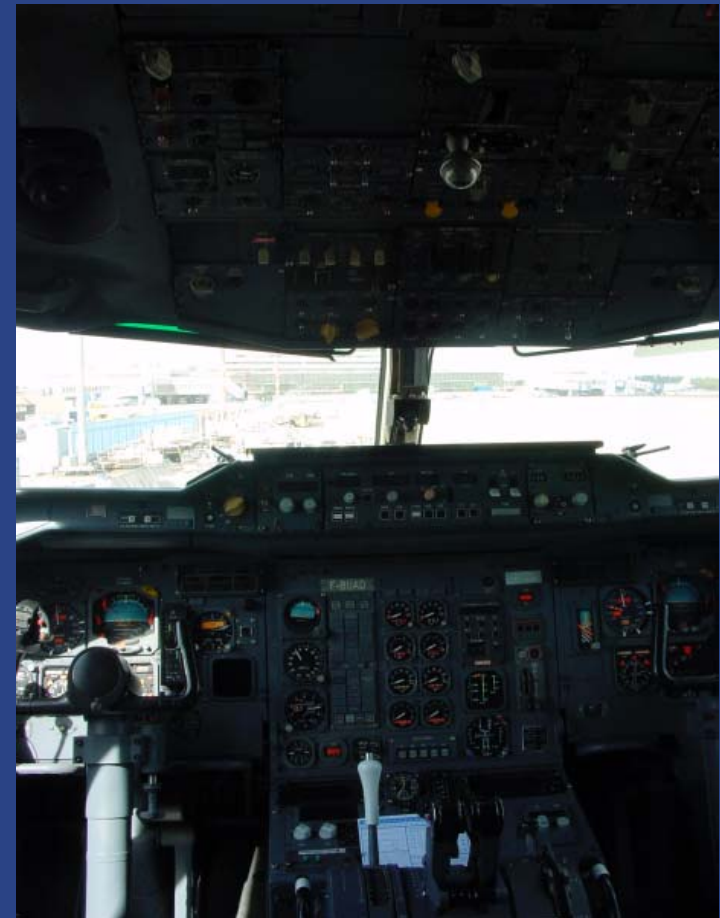


# Automated Component Test Platform ACTP for Aerospace Applications

Dr. Gerd Schmitz

S.E.A. Datentechnik GmbH  
Linder Höhe; 51147 Köln  
++ 49 22 03 – 69 92 - 0  
[www.sea-gmbh.com](http://www.sea-gmbh.com)





- ◆ System integration provider for test, control and measurement applications
- ◆ National Instruments Alliance Partner since 1990
- ◆ 1995 renaming of KBS to S.E.A. Datentechnik GmbH
- ◆ currently 21 employees
- ◆ location:  
Cologne, on site of German Research Center for Aerospace and Aeronautics (DLR)

## Competencies



Motor test stand



Automated test equipment



Turbine test stand



Electronic component characterization

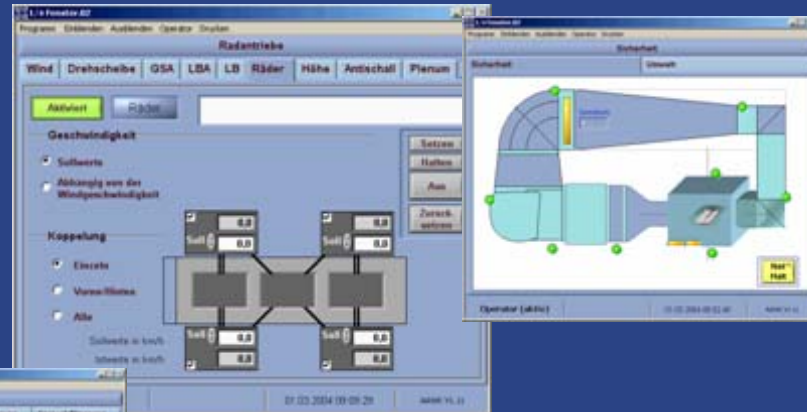


## S.E.A. Aerospace and Space Research Examples

### WTCS Wind Tunnel Control System

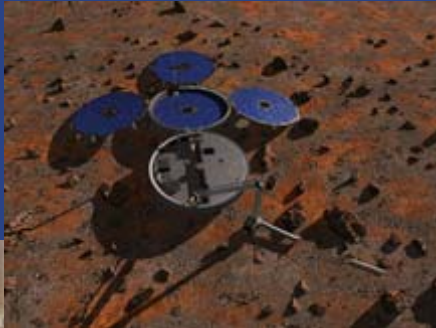
Integrated control and data management system for wind tunnel application

- ❖ Climate control
- ❖ Suction and pressure measurements
- ❖ Rolling road
- ❖ Fan control
- ❖ Balance & positioning system
- ❖ Vision support

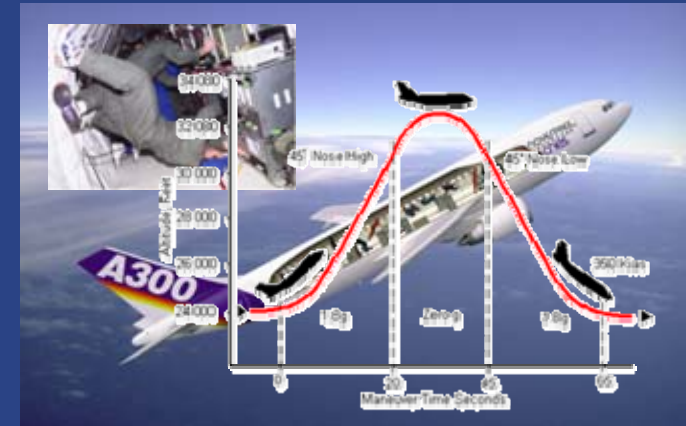
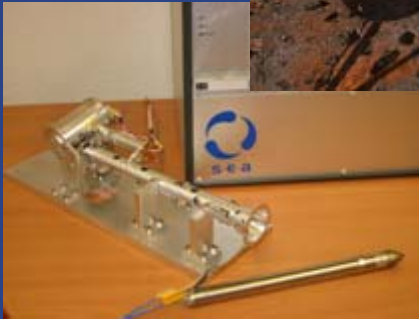


- ❖ Scalable client/server architecture
- ❖ Single and multi-user operation
- ❖ Multi-screen visualisation
- ❖ Support for realtime system integration

## S.E.A. Aerospace Research Examples



Mars Beagle



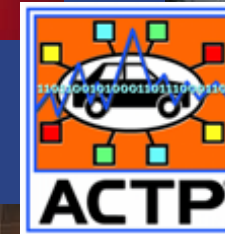
Parabola Flight

## ROSETTA Lander



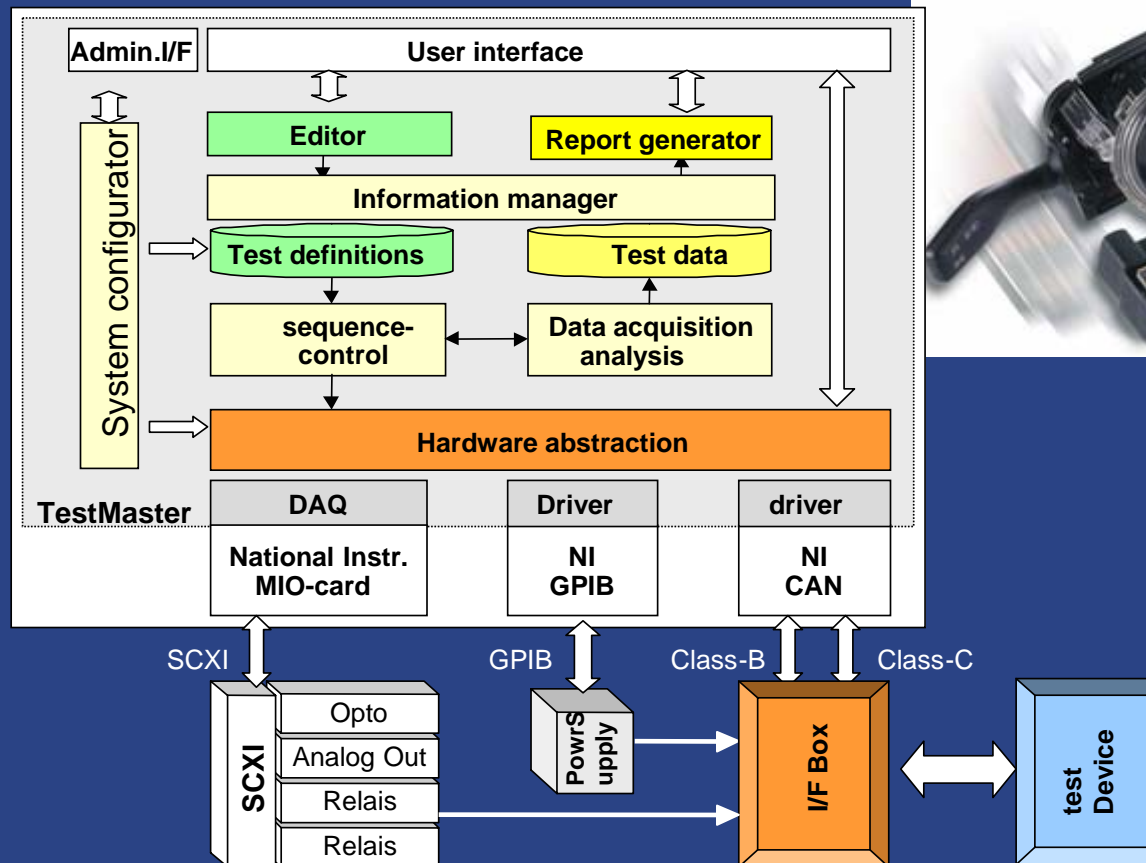
ROSETTA LANDER beim Vibration Test



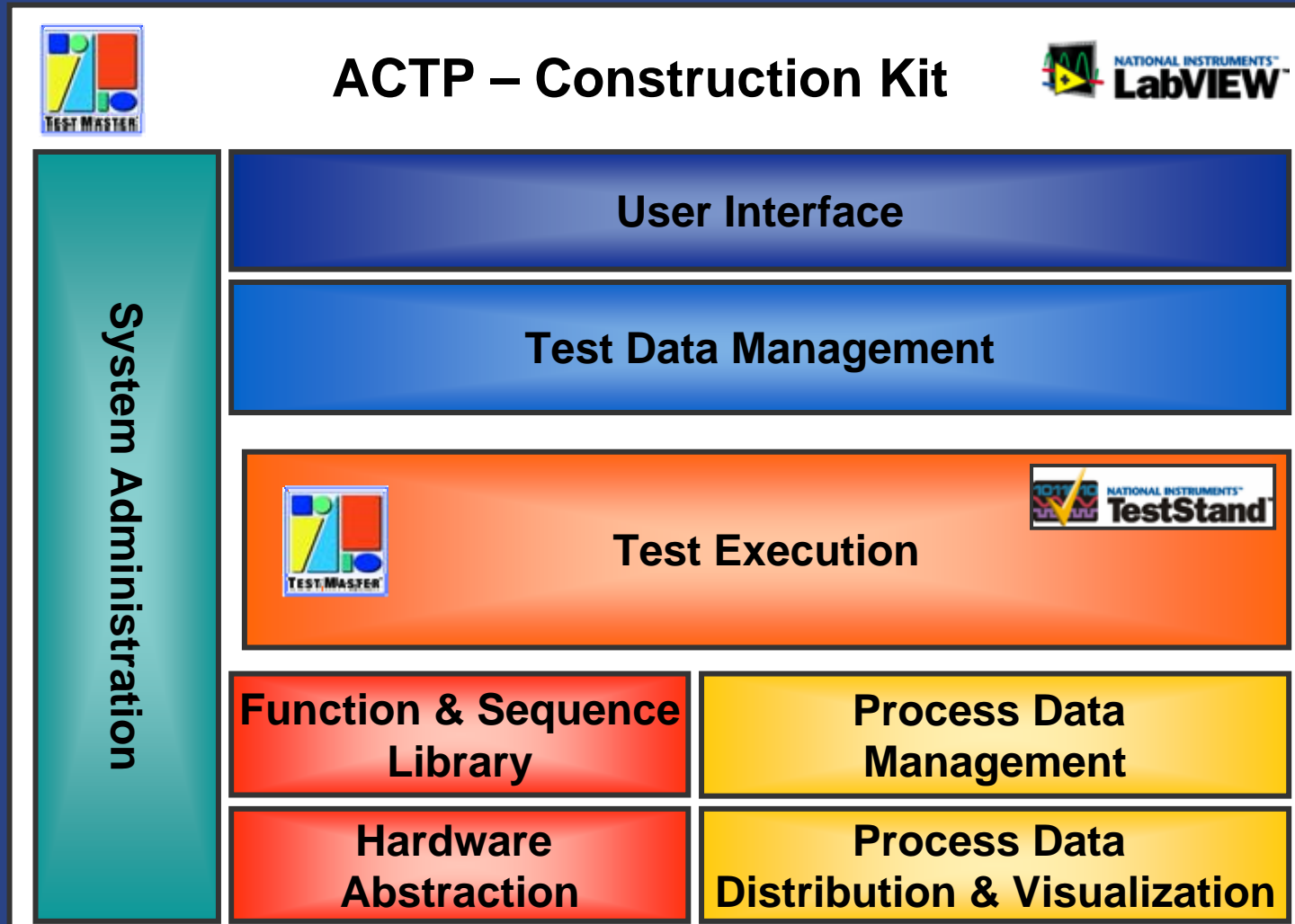


## Test system for electronic components in development

### steering column modules



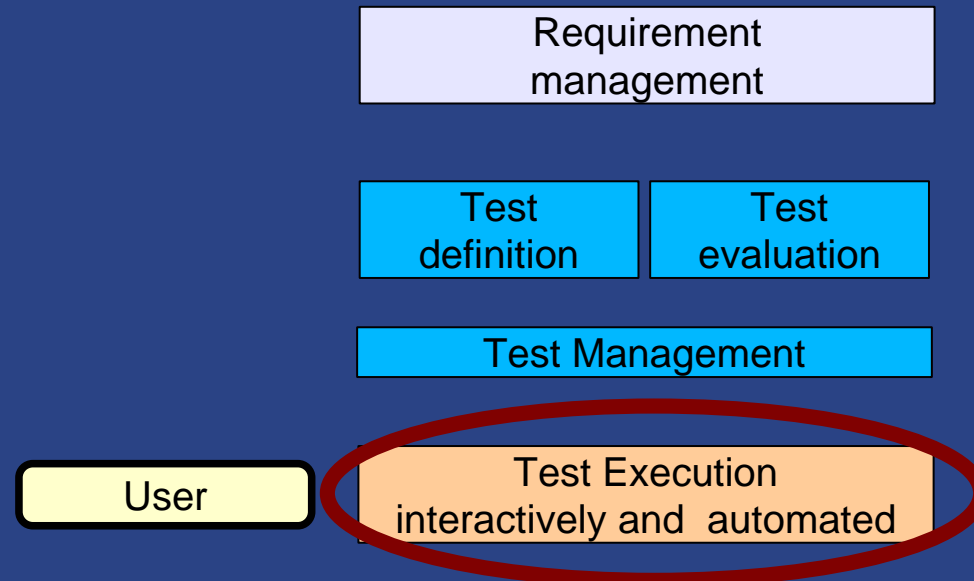
## ACTP Toolkit for Electronic Component Testing



## Role of Test Execution

Integration of the components of the overall test process

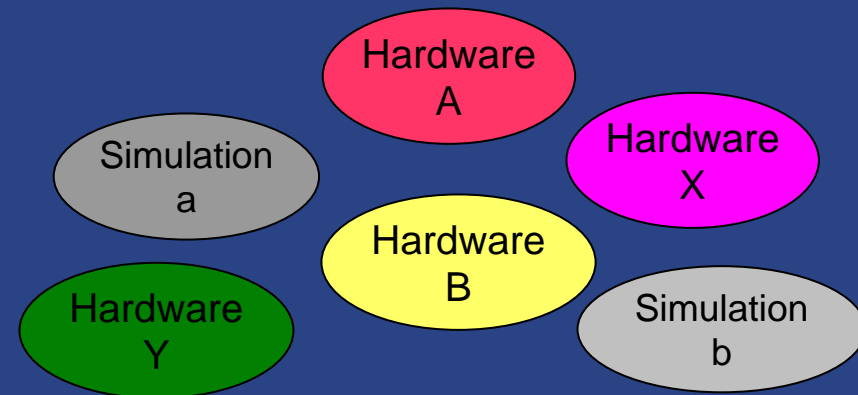
- ◆ Test definition
- ◆ Software functionality
- ◆ Hardware interfaces
- ◆ Data and result management



## Interface to the user for

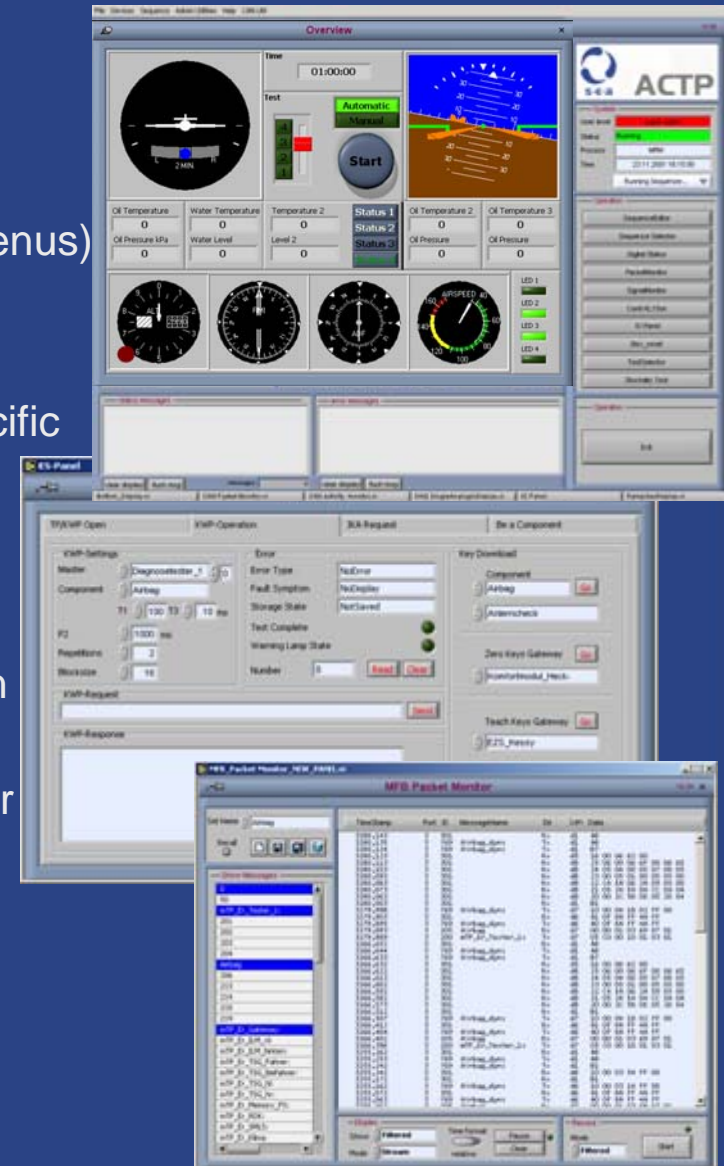
- ◆ configuration
- ◆ supervision
- ◆ operation

of test system configuration and test execution




## Automated Component Test Platform

- ◆ user-friendly easy to use solution
- ◆ interactive and automated test execution
- ◆ flexible configuration of active elements (buttons and menus)
- ◆ covers the complete test workflow including test data management
- ◆ open interface allows easy integration of customer specific
  - ◆ hardware
  - ◆ functional modules
  - ◆ data management infrastructure
- ◆ supports a huge variety of measurement and stimulation hardware
- ◆ supports aerospace specific hardware (ARINC) and user displays
- ◆ status and error indication
- ◆ display management for multi screen applications
- ◆ Set management
- ◆ User management



## Example: Hardware abstraction in the TestMaster user interface

- user-selectable abstracted digital Signals in the standard IO-Panel



The screenshot displays the TestMaster software interface. At the top, there are menu options: File, Devices, Sequence, Admin Utilities, Help, and CAN Util. Below the menu, there are several data panels:

- Port1:** cycle1, CAN Err. 1, 200, cycle 1, Distribution state, Run top, cycle 1.
- Port2:** cycle2, CAN Err. 2, 20, received 1, received 2, cycle 2.

The main area is the **IO Panel**, which is divided into **Parameter Sets** and **IO Panel** (VI.00). The **Parameter Sets** section shows a **Set Name** of "Elinker". The **IO Panel** is split into **Inputs** and **Outputs**.

**Inputs:**

- MFRM - MFRM-Statusbyte2 (BU\_RE)
- MFRM - MFRM-Statusbyte2 (BU\_LI)
- MFRM\_A1 - Fernlicht einschalten
- MFRM\_A1 - Richtungsblinken Links
- D\_RS\_MFRM - Schalterdaten Tempomat: S+B
- D\_RS\_MFRM - Schalterdaten Tempomat: WA
- D\_RS\_MFRM - Schalterdaten Tempomat: AUS
- D\_RS\_MFRM - Schalterdaten Tempomat: KSK
- D\_RS\_MFRM - Schalterdaten Tempomat: S-B
- D\_RS\_MFRM - Schalterdaten Tempomat: Vmax aktive
- D\_RS\_MFRM - Schalterdaten Lenksäule ab
- D\_RS\_MFRM - Schalterdaten Lenksäule auf
- D\_RS\_MFRM - Schalterdaten Wippe 4\_2
- D\_RS\_MFRM - Schalterdaten Wippe 4\_1
- D\_RS\_MFRM - Schalterdaten Wippe 1\_2
- D\_RS\_MFRM - Schalterdaten Wippe 1\_1
- D\_RS\_MFRM - Schalterdaten Hupe ein

**Outputs:**

- Power
- Richtungsblinken Rechts
- Richtungsblinken Links
- Hupe einschalten
- Licht einschalten
- Fernlicht einschalten
- Fernlicht aus
- Fernlicht HiLo
- Fernlicht EinAus
- Wippe
- Hupe
- Heizung ein
- Klima ein

At the bottom, there are **status messages** and **error messages** sections, each with "clear display" and "flush msg" buttons. The **messages** counter shows 0.

On the right side, there is a **System** panel with the S-E-A logo and ACTP text. It shows:

- User level:** super admin
- Status:** Running
- Process:** MRM 171
- Time:** 23.11.2001 18:43:18
- Running Sequencer...**

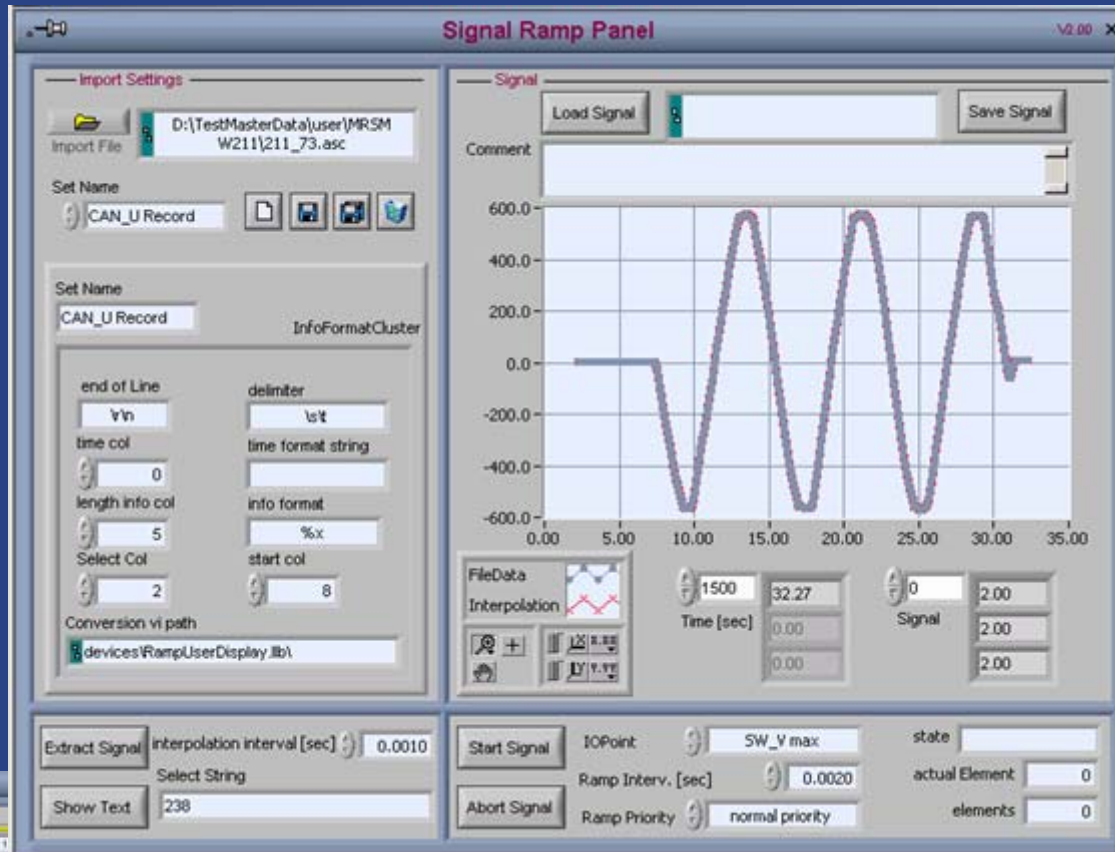
Below the system panel, there is an **Operation** panel with buttons for:

- SequenceEditor
- Seq. Select
- Digital Status
- PacketMonitor
- SignalMonitor
- Conti HL15on
- Shut down
- Box\_reset
- TestSelector
- Stochastic Test

At the bottom right, there is an **Exit** button.

## Function example: Signal generation

- RampAbort.vi
- RampCheckActivity.vi
- RampGetState.vi
- RampHold.vi
- RampInit\_File.vi
- RampInit\_ImportText.vi
- RampInit\_Linear.vi
- RampResume.vi
- RampStart.vi
- RampStop.vi
- RampWaitforEnd.vi

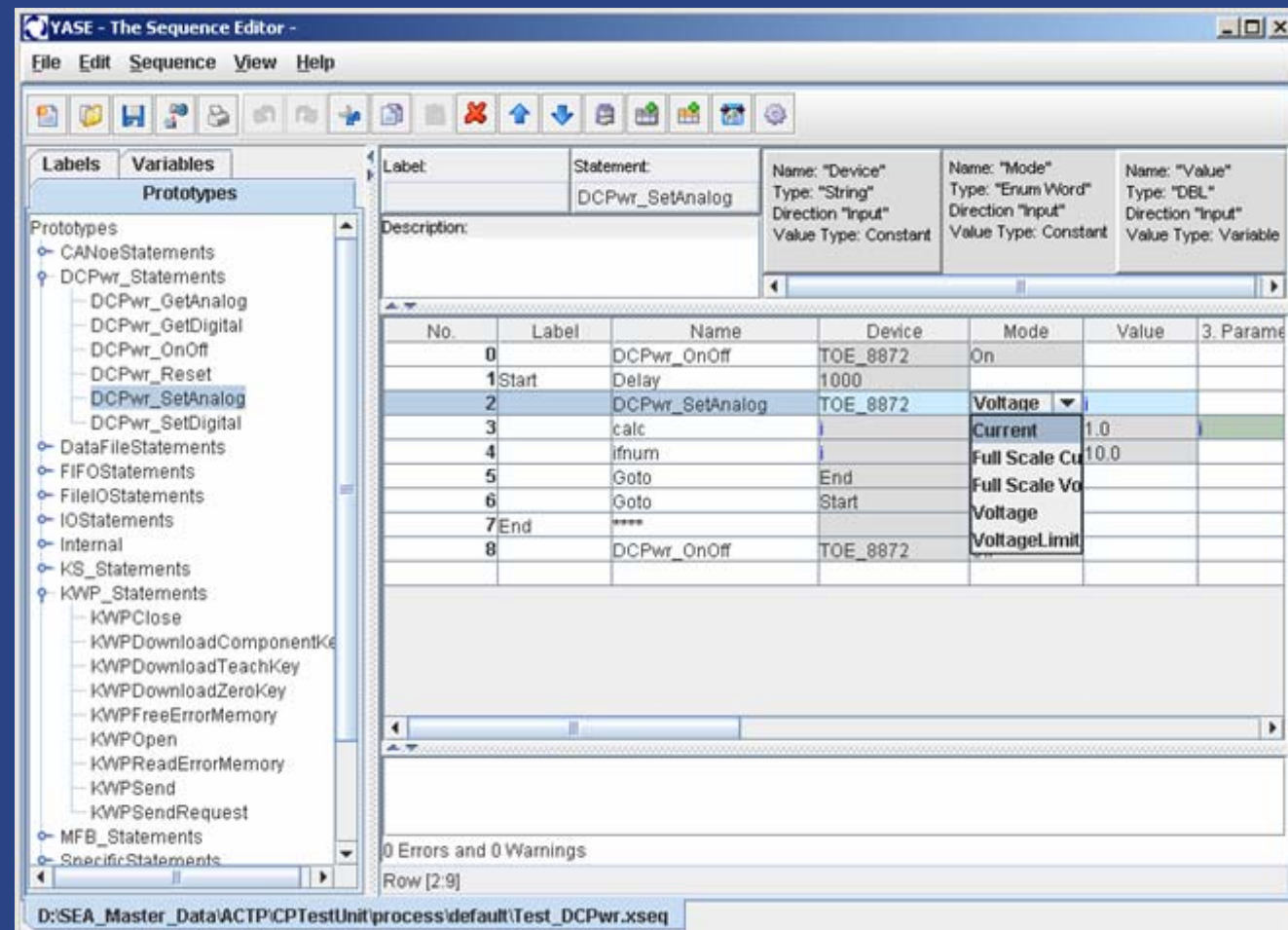



LWS_CO	Signal	Handbook	Start Time	Revisions	State	Priority	LastStateChange	Inval priority	NoElements
LWS_CO	Signal	Handbook	01.00.00.000	1	State	Priority	01.01.04	at 0.0000	
LWS_CO	Signal	Handbook	01.00.00.000	1	State	Priority	01.00.08.00	01.02.04	NoElements 1000
LWS_CO	Signal	Handbook	01.00.00.000	1	State	Priority	01.00.08.00	01.02.04	NoElements 1000
LWS_CO	Signal	Handbook	01.00.00.000	1	State	Priority	01.00.08.00	01.02.04	NoElements 1000
LWS_CO	Signal	Handbook	01.00.00.000	1	State	Priority	01.00.08.00	01.02.04	NoElements 1000
LWS_CO	Signal	Handbook	01.00.00.000	1	State	Priority	01.00.08.00	01.02.04	NoElements 1000
LWS_CO	Signal	Handbook	01.00.00.000	1	State	Priority	01.00.08.00	01.02.04	NoElements 1000
LWS_CO	Signal	Handbook	01.00.00.000	1	State	Priority	01.00.08.00	01.02.04	NoElements 1000

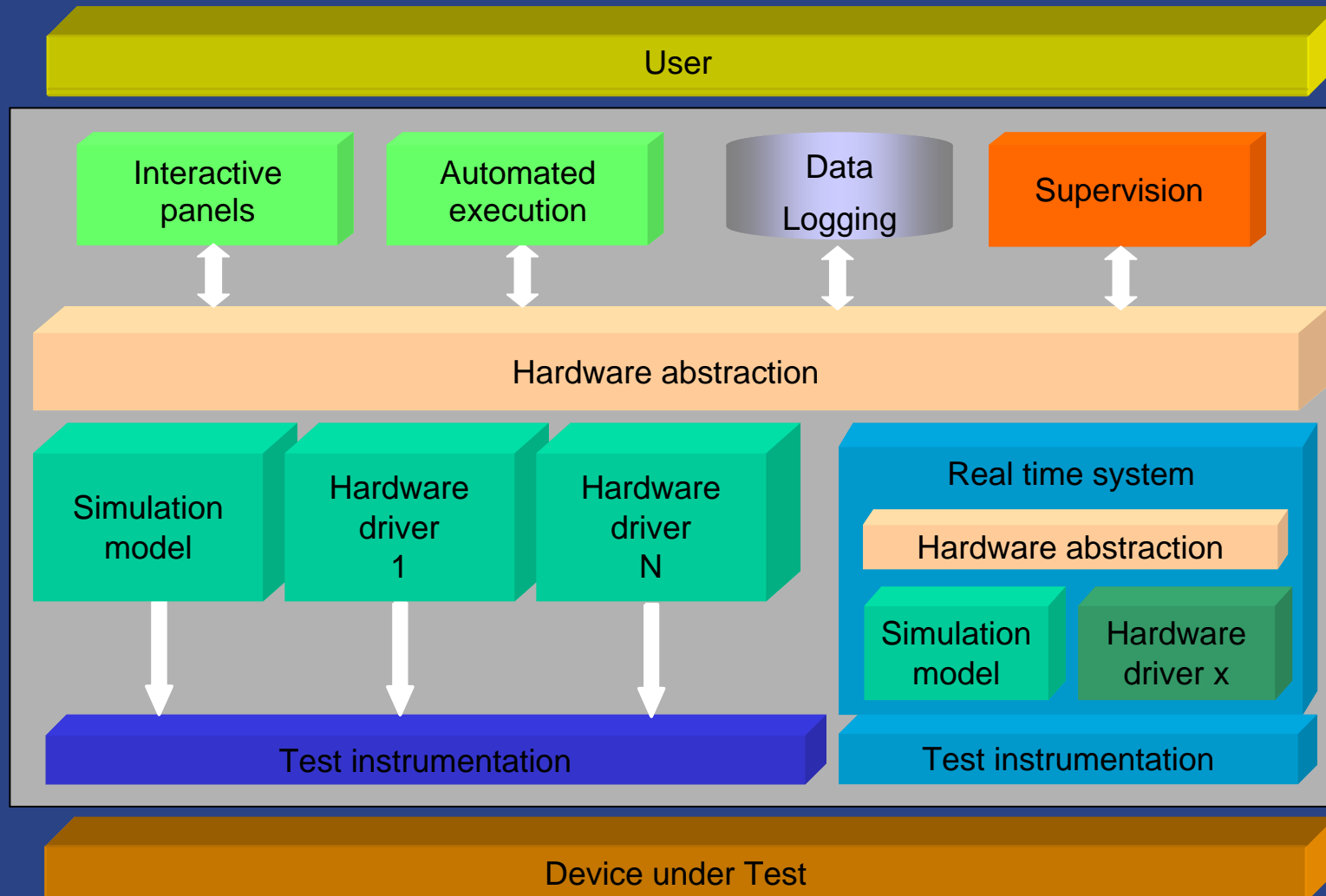
Replay of recorded or generated signal pattern on any supported hardware, for example for flight state simulation of recorded flight situation on the ARINC bus

## Sequence Editor YASE offers...

- ◆ User-friendly definition of control and test execution flow
- ◆ Easy access to all ACTP and user-defined functionalities
- ◆ Comfortable selection of signals and settings
- ◆ No programming
- ◆ Easy extendable with LabVIEW modules

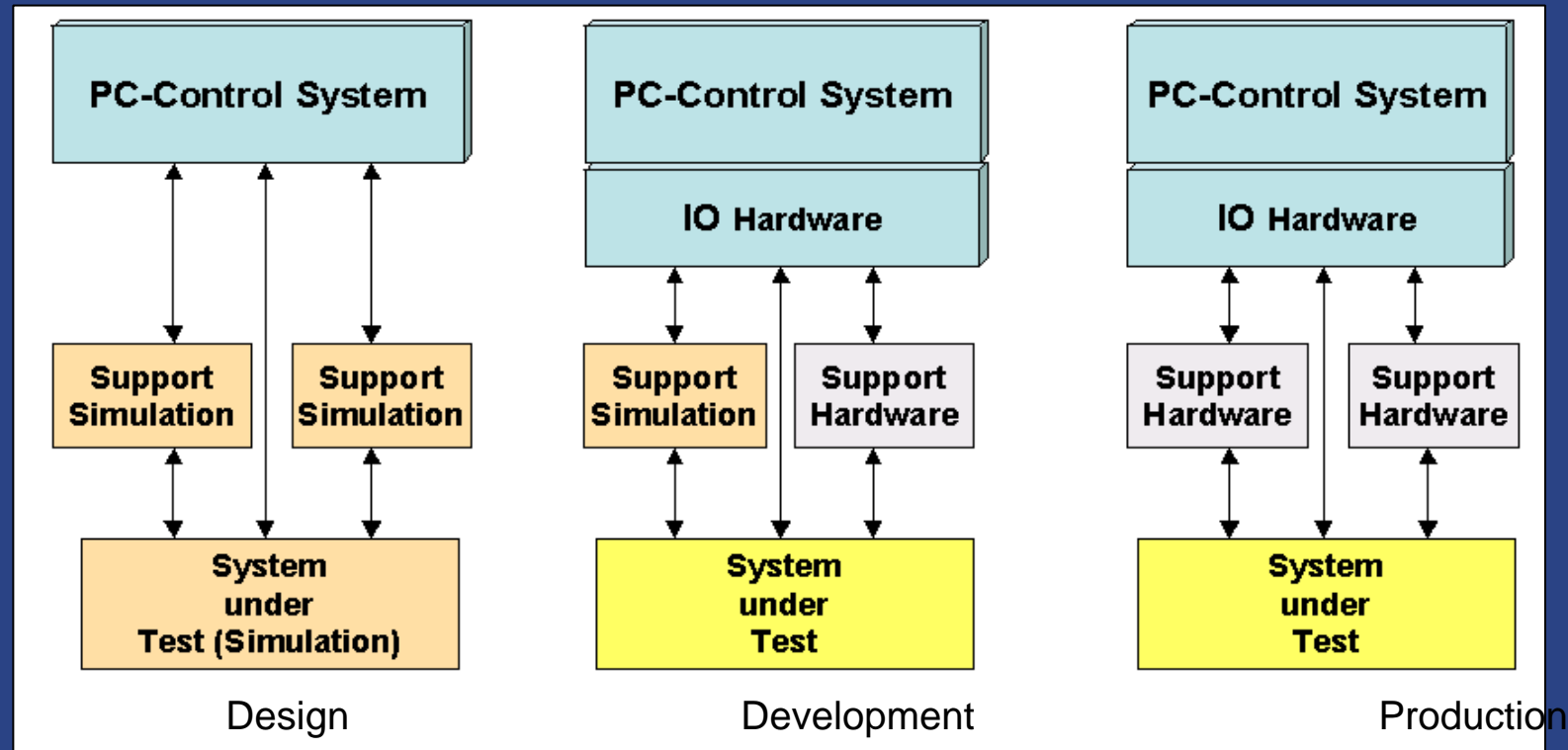
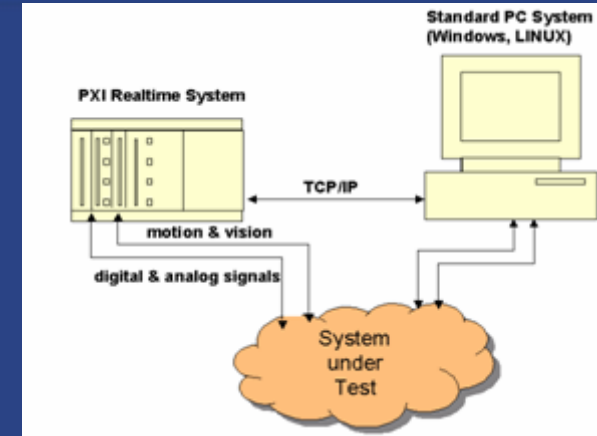


## Hardware Abstraction

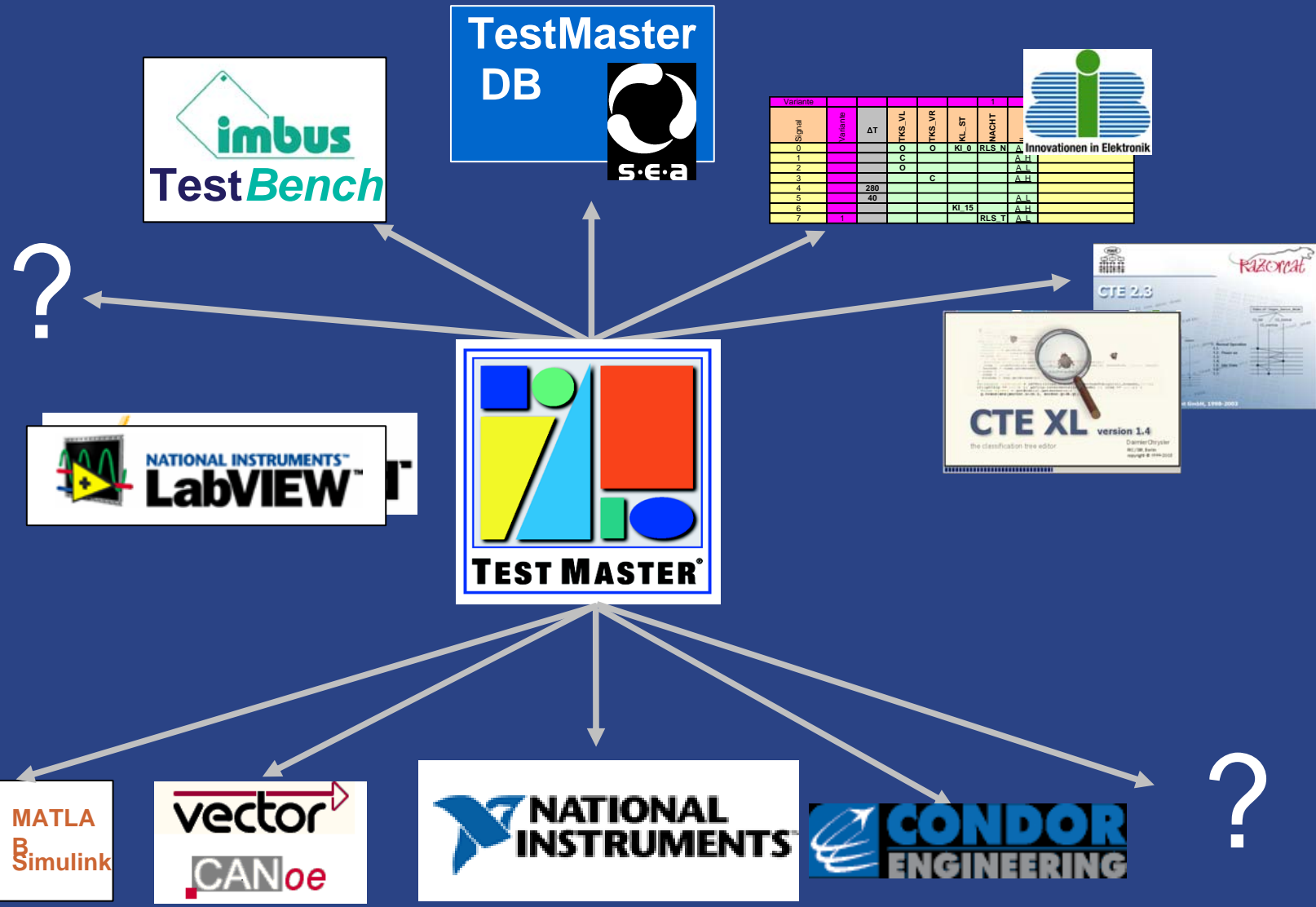


## TestMaster SIM

- ◆ Is a shared TestMaster application for integration of real-time HIL Simulation
- ◆ uses cases for application of simulation and HIL in the test environment



## ACTP Workflow Integration



Name	Beschreibung	Version	changed	device	ID
_sea_Bit_stochTest		3	15.09.00 16:37:38		2395
Blinker Simple		7	05.09.00 14:06:47		2373
Blinker Unterspannung	Spezialtest Unterspannung mit aktivem Blinker	8	11.01.01 14:15:33		2407
Dauerlaufstest SleepMode		6	08.09.00 14:58:28		2384
Diagnose		40	01.09.00 16:48:47		2362
LED Lenksäulenverstellchalter		5	14.07.00 13:44:09		2265
LED_Lenkradheizung		4	02.09.00 10:12:08		2368
Lenksäulenverstellchalter	Testet die Lenksäulenfunktion	2	01.09.00 14:56:56		2359
<b>Lenkwinkel Tests</b>	<b>Testet Lenkwinkelaktionen</b>	<b>5</b>	<b>11.09.00 15:14:31</b>		<b>2392</b>
LenkwinkelHardNI	Lenkwinkel wird Hard_initiaisiert	18	15.08.00 15:02:31		2308
LWS TurnSpeed		5	14.07.00 13:43:49		2263
LWS_PowerOn		9	14.07.00 13:43:38		2262
MRSM auslesen		8	18.08.00 09:10:40		2324
Passive Run Mode	Teste den Passive Run Mode für LWS	19	14.07.00 13:43:27		2261
PowerOn		6	11.01.01 08:59:06		2405
Prototype_IL_C		7	07.03.00 07:45:00		1994
Prototypen-Test	Sammlung aller aktuellen Teststeps für den Gesamttest	107	11.09.00 09:24:48		2387
Stromaufnahme		32	08.09.00 11:55:20		2378
Test-Te_Li		12	14.07.00 13:45:07		2271
U_Treppe		7	14.07.00 13:44:57		2270
Unplausibel		5	14.07.00 13:44:47		2269

### Test Parameter

Lenkwinkel Tests ID: 2410

Initial Sequence: LED\_test\_Lenksäule.seq  
Exit Sequence: TestParams.seq

Name	Default Value
Sleep_Run	Sleep
Spannung	5.50
Strom	500

Datensatz: 2 von 3

Close

### Testeditor

Test Name: Lenkwinkel Tests TestID: 2410

Test step	description	version	step ord
Power On	schalte Netzteil mit globalen Variablen ein	7	1
Power Lab	ändert den globalen Spannungswert laut der Tabelle	1	2
SP_KL15 ein	sendet kontinuierlich KL15	4	3
check CAN	prüft den CAN, wenn 5 dem CAN_motto auf abstimmt	1	4
Lenkwinkel PD komplex	Testet die Hardware, Initialisierung aus verschiedenen Lenkwinkel	1	5
KL15 close	beendet das kontinuierliche Senden	1	6
check Power Off	schalte Netzteil aus	4	7

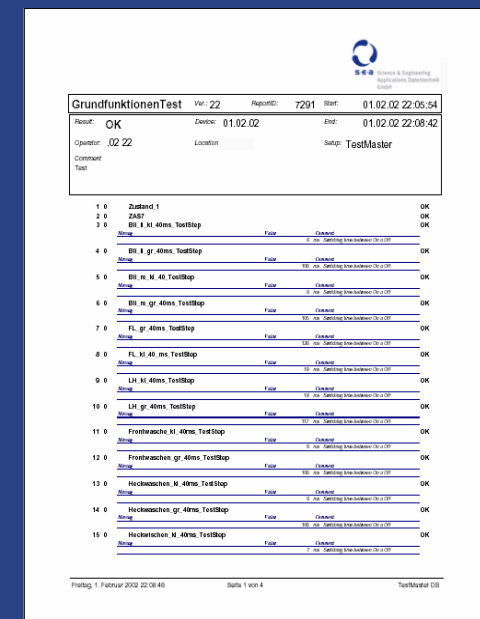
Buttons: Insert Step, Delete Step, Print Table, Main Menu

comment:  created: 11.09.00 12:19:55 changed: 11.09.01 14:10:57

Buttons: Discard changes, Save New Version

## Test Definition & Results Database

- Test definition is performed in a SQL database
- Test results are stored in the SQL test database
- Print of reports in PDF format



GrundfunktionenTest Ver: 22 AppartID: 7291 Start: 01.02.02 22:05:54

Result: OK Device: 01.02.02 End: 01.02.02 22:08:42

Operator: 0222 Location: TestMaster

Comment: Test

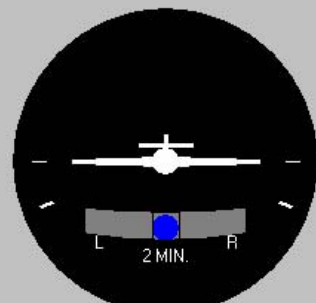
1	0	Zustand 1	OK
2	0	Zustand 2	OK
3	0	BI_1.gr.40ms_TestStop	OK
4	0	BI_1.gr.40ms_TestStop	OK
5	0	BI_n.M.40_TestStop	OK
6	0	BI_n.gr.40ms_TestStop	OK
7	0	FL.gr.40ms_TestStop	OK
8	0	FL.M.40.ms_TestStop	OK
9	0	LH.M.40ms_TestStop	OK
10	0	LH.gr.40ms_TestStop	OK
11	0	Freiwäsche.M.40ms_TestStop	OK
12	0	Freiwäsche.gr.40ms_TestStop	OK
13	0	Hochwaschen.M.40ms_TestStop	OK
14	0	Hochwaschen.gr.40ms_TestStop	OK
15	0	Hochwaschen.M.40ms_TestStop	OK

Printed: 1 Februar 2002 22:08:40 Seite 1 von 4 TestMaster 018



## Example ARINC simulation and control

Overview



Time  
01:00:00

Test

4

3

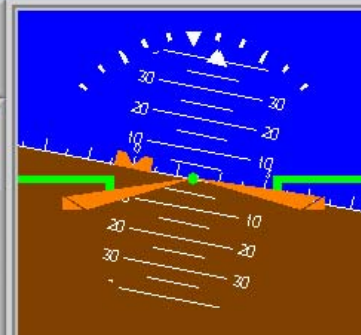
2

1


Automatic


Manual


Start




Oil Temperature 0	Water Temperature 0	Temperature 2 0	Status 1 Status 2 Status 3 Status 4	Oil Temperature 2 0	Oil Temperature 3 0
Oil Pressure kPa 0	Water Level 0	Level 2 0		Oil Pressure 0	Oil Pressure 0









LED 1

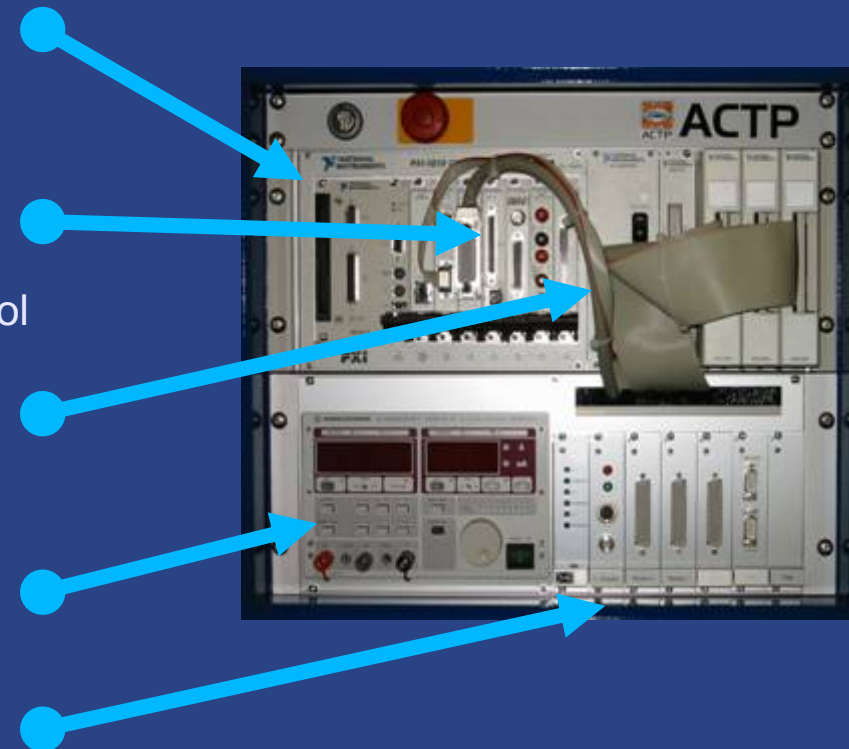
LED 2

LED 3

LED 4

## Example compact hardware 19" rack setup

- ◆ National Instruments PXI controller and data acquisition modules for physical stimulations and measurements
  - ◆ variety of analog u. digital modules
  - ◆ PCMCIA Condor ARINC 429 module
  - ◆ NI GPIB-Interface for benchtop device control e.g. power supply
- ◆ SCXI modules for signal conditioning
  - ◆ relais, opto couples
  - ◆ Isolated analog in and outputs
- ◆ power supply
- ◆ Interface to test devices via dedicated project specific adaptation electronics for electrical and mechanical adaptation



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