



BETA-AIR & AVIAOK



# The Development of Scalable Test Systems : from Flight to Laboratory Testing

by BETA AIR & AVIAOK International Companies

Hamburg, April 2005



**BETA-AIR & AVIAOK**



## **Field of activities:**

**BETA-AIR**

**Sensors  
Avionics  
Test equipment  
ATE-200 (ARINC-608A)**

**AVIAOK**

**Software  
MOBILE ATE  
Computer-Aided Design  
International Business Support**



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# **AVIAOK International**

**is a provider of engineering services  
(software, automatic test equipment, IT solutions)  
for a wide range of industry applications  
basically for aerospace electronics.**

## **Basic Activities of AVIAOK:**



### **Outsourcing services:**

Software development  
Computer-Aided Design (CATIA)



### **Automatic Test Equipment (ATE)**



**Digital Control Systems development**



**Experimental production**



**International Business Support**



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## **BETA AIR** the Developer of ATE-200

- **BETA AIR** was established in 1991 to implement Be-200 Amphibious Aircraft project.
- Currently **BETA AIR** is an R&D center working on electronics both for aviation and general application industry.



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## Multi-purpose Amphibious Aircraft Be-200





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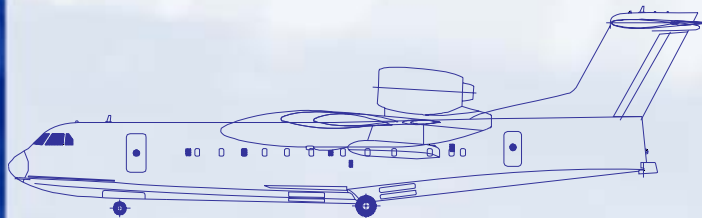
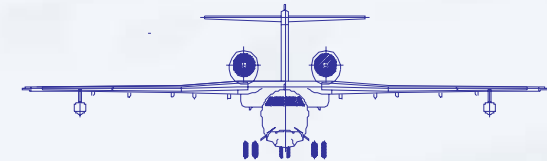
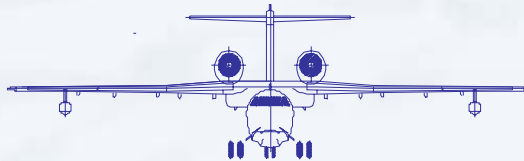
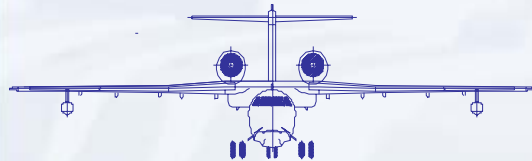


*Implementation of End-to-end Solution for Airborne Equipment Control by BETA AIR & AVIA OK*

- BETA AIR & AVIAOK use multistage comprehensive approach to check airborne equipment in BE-200 project
- Each stage may influence the entire process or modify subsequent process steps

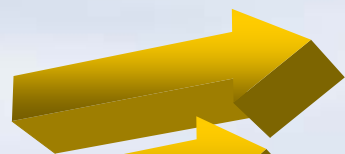


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## BE-200 TEST&MEASUREMENT SOLUTION

STEP 1



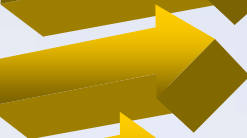
Vibration & Acceleration control

STEP 2



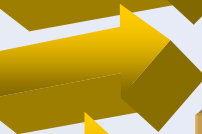
Data acquisition in ARINC-429 channels

STEP 3



Network measuring and computing complex

STEP 4



LRU testing with MOBILE ATE

STEP 5

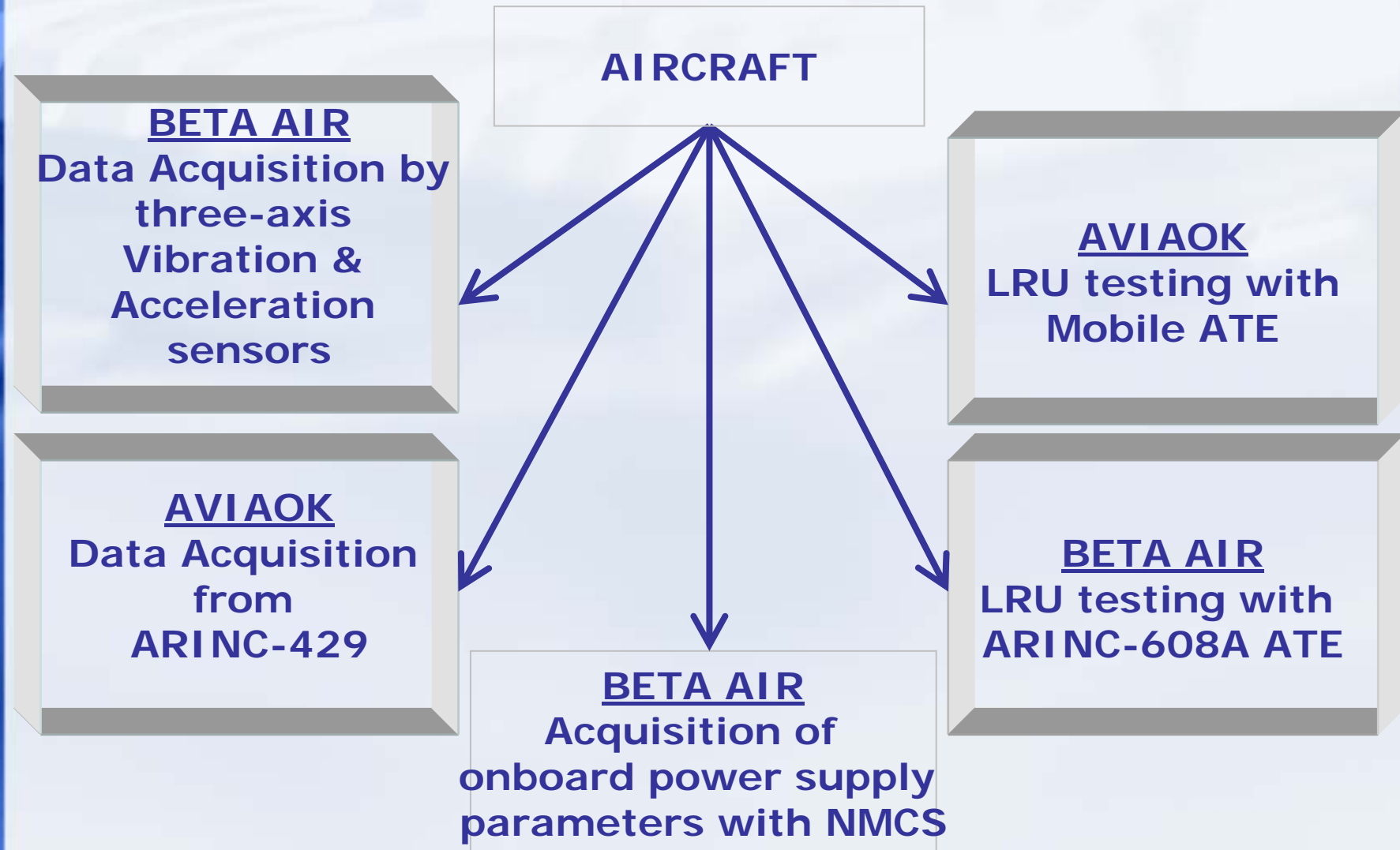


LRU testing with ATE-200

Steps of Airborne Equipment Monitoring

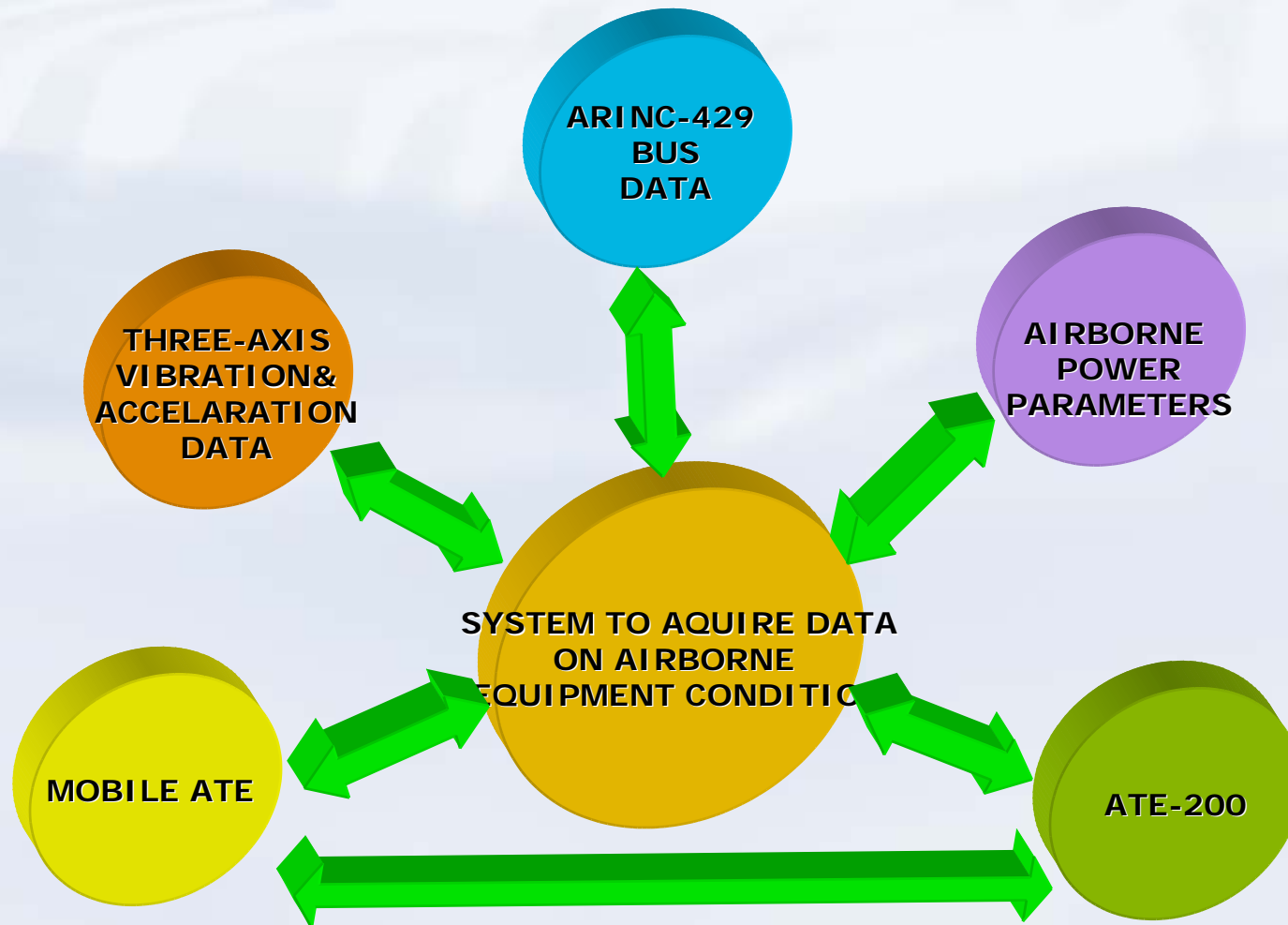


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10 000 h



ARINC-429 BUS CONTROL

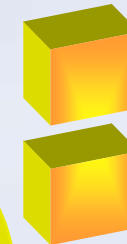
THREE-AXIS VIBRATION & ACCELERATION CONTROL

CONTROL OF AIRBORNE POWER PARAMETERS



TESTING WITH MOBILE ATE

TESTING WITH ATE-200



14 000 h



Reduced MTBUR rates





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**NI LabView**

ARINC-429 BUS CONTROL

THREE-AXIS VIBRATION & ACCELERATION CONTROL

CONTROL OF AIRBORNE POWER PARAMETERS

**NI TestStand**

MOBILE ATE

**Beta-Air ProTest**

ATE-200

One concept  
Different Realizations

ProTest operates with PXI devices and is a SOFTWARE ADAPTER

Data on Airborne System Monitoring are integrated on various steps.

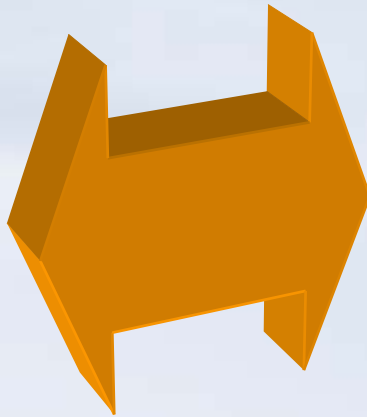
Software application end-to-end solution



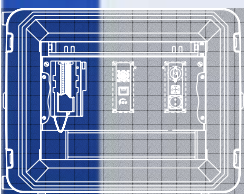
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The correction of LRU's operation mistakes



The comprehensive approach allows to correct LRU after processing data received on every step as well as on summary analysis of LRU operation.





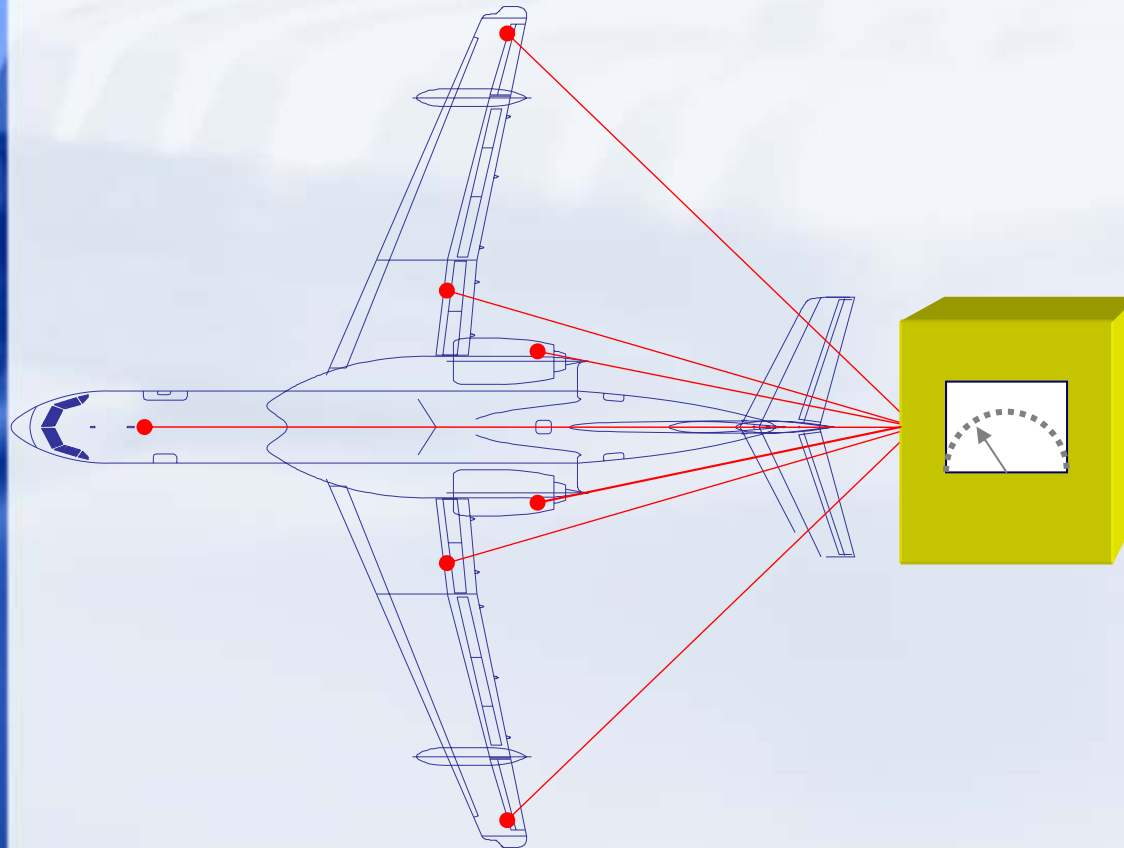
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- 1. Vibration and Acceleration Data Acquisition
- 2. ARINC-429 and MIL-1553 Data Acquisition
- 3. Onboard Power Systems Data Acquisition
- 4. LRU Testing with MOBILE ATE
- 5. LRU Testing with ATE-200



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BETA AIR designed and introduced Acceleration and Vibration Sensors adapted to the use with Onboard Measuring Systems.

Three-axis accelerometers are used not only as vibration sensors but also to indicate tilt angle and linear acceleration of an object.

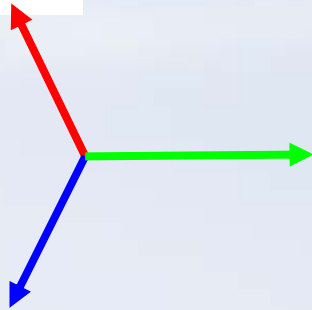
- *Operational frequency range: 0 – 2000 Hz*
- *Acceleration resolution range : from  $\pm 2.5g$  to  $\pm 50 g$*



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## Universal accelerometers are specially designed for aircraft certification testing.



The devices can be installed in any place of an aircraft due to their small size. The sensors feature simultaneous measurement of acceleration along three mutually perpendicular axes.

Unlike piezoelectric sensors, acceleration and vibration sensor (IPV) has a standardized voltage output and doesn't require coupling amplifiers.

The 27V consumption makes the devices compliant to onboard power supplies .



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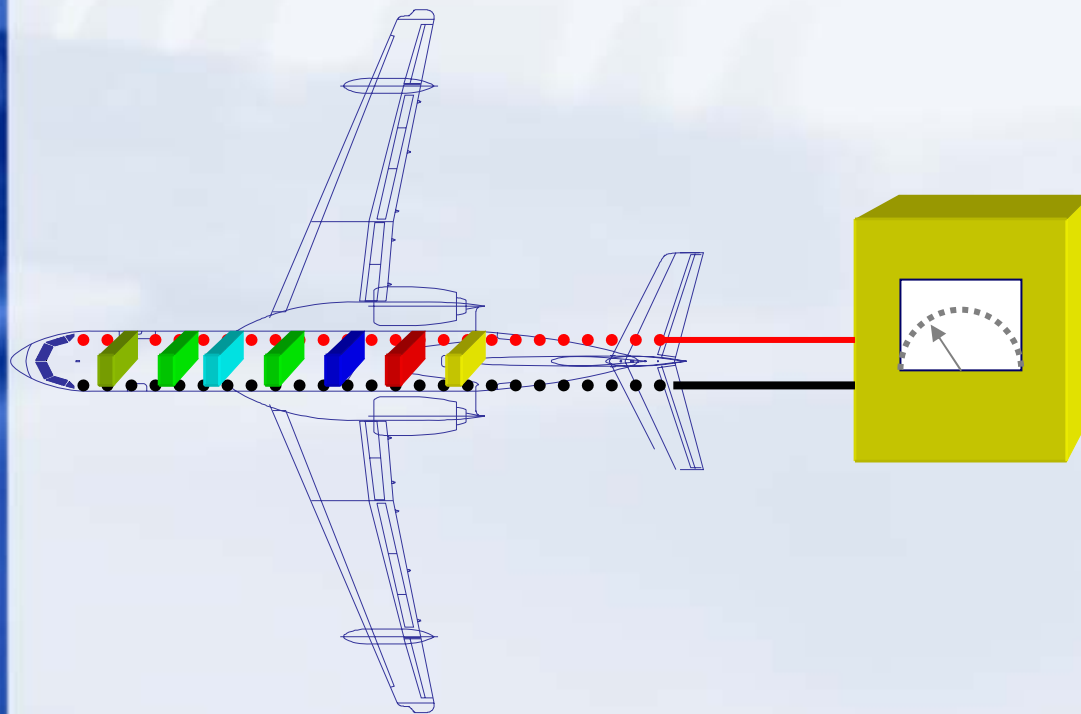
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AVIAOK develops ARINC429 and MIL-1553 receivers and transmitters based on cRIO platform.



Arrangement of monitoring system components interconnected via ARINC429 and MIL-1553 busses is much simplified.

This system allows to track data received from arbitrary device in arbitrary moment.

- *ARINC-429 bit rate from 11KHz to 100KHz*
- *Multi-function and single-function MIL-1553 versions*





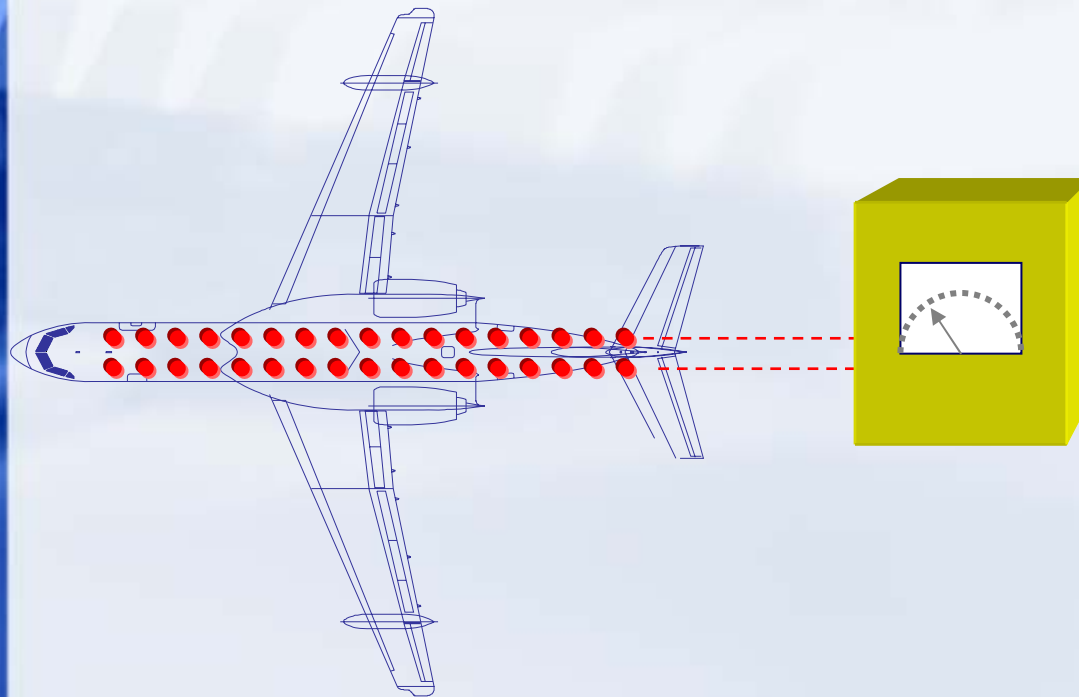
BETA-AIR & AVIAOK



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Network measuring and computing system (NMCS) is designed to measure onboard power system parameters in various flight conditions.

The complex is a set of data acquisition units (DCU) incorporated into the local area network under control of both a host-computer and an external system.

**AC voltage 0 - 380 V**

**Alternating current  $\pm 600$  A**

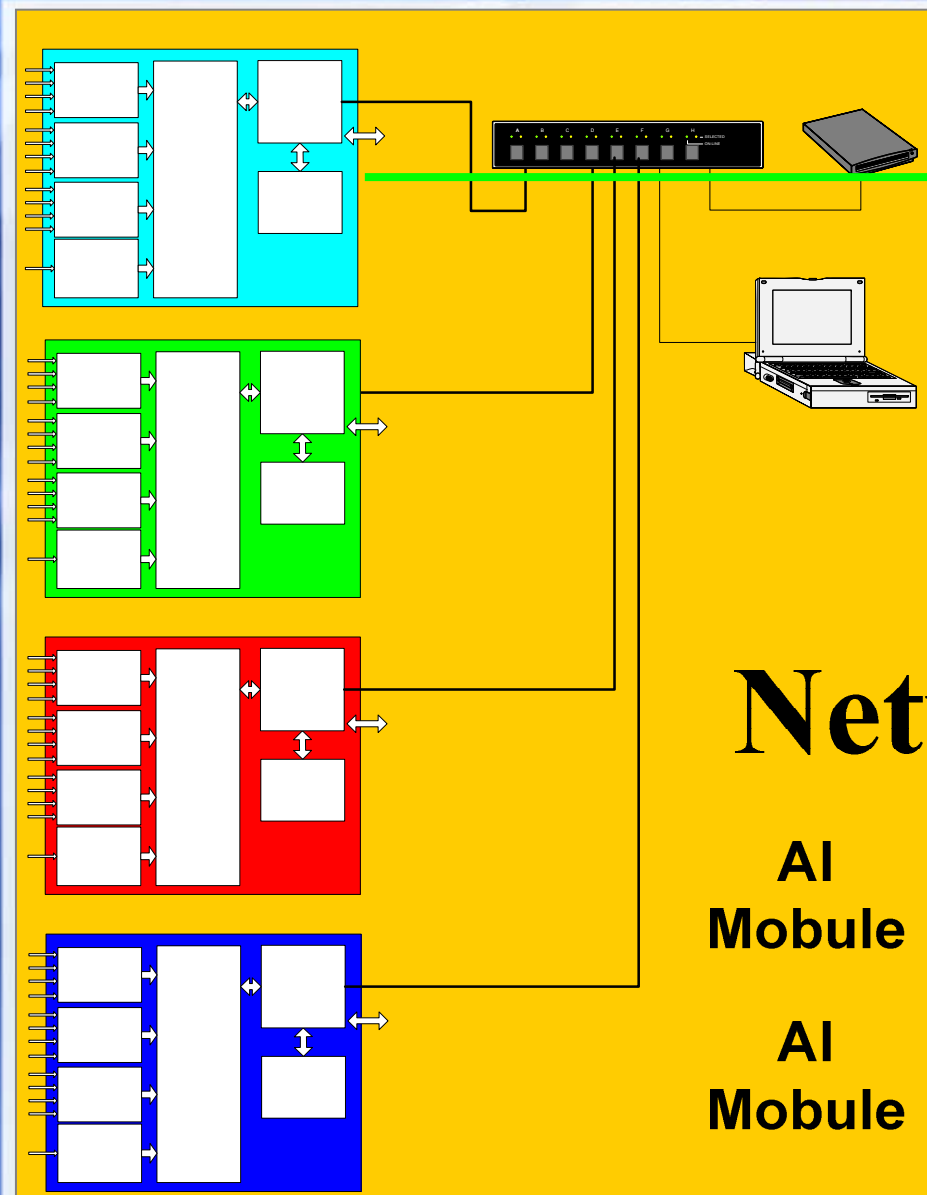
**DC voltage 0 - 100 V**

**Direct current 0 - 1200 A**

**Alternating current frequency 5-480 Hz**



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- NMCS is built on NI cRIO devices.
- cRIO controller, attached chassis and cRIO modules are combined into one data acquisition unit (DCU).
- Several DCUs are interconnected via Ethernet and LAN connected with a host-computer or HDD.

# Network measuring an

AI  
Mobule  
AI  
Mobule

Real Time Controller  
Ethernet  
RS232

Chassis  
4-slot.  
cRIO  
RAM  
64 Mb



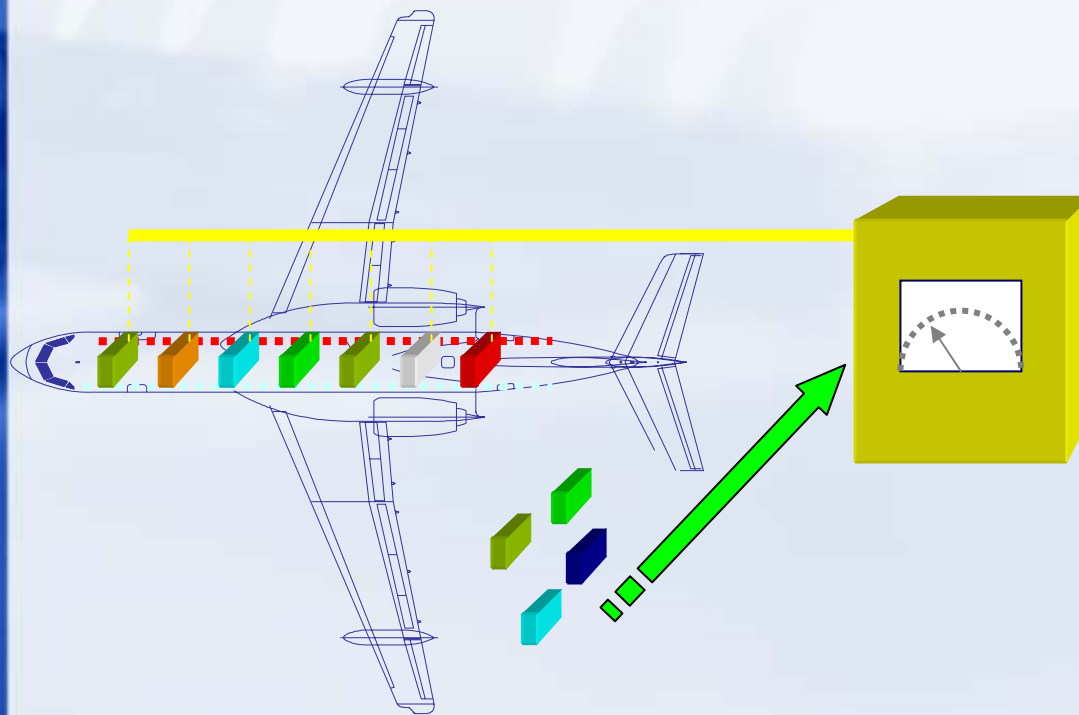
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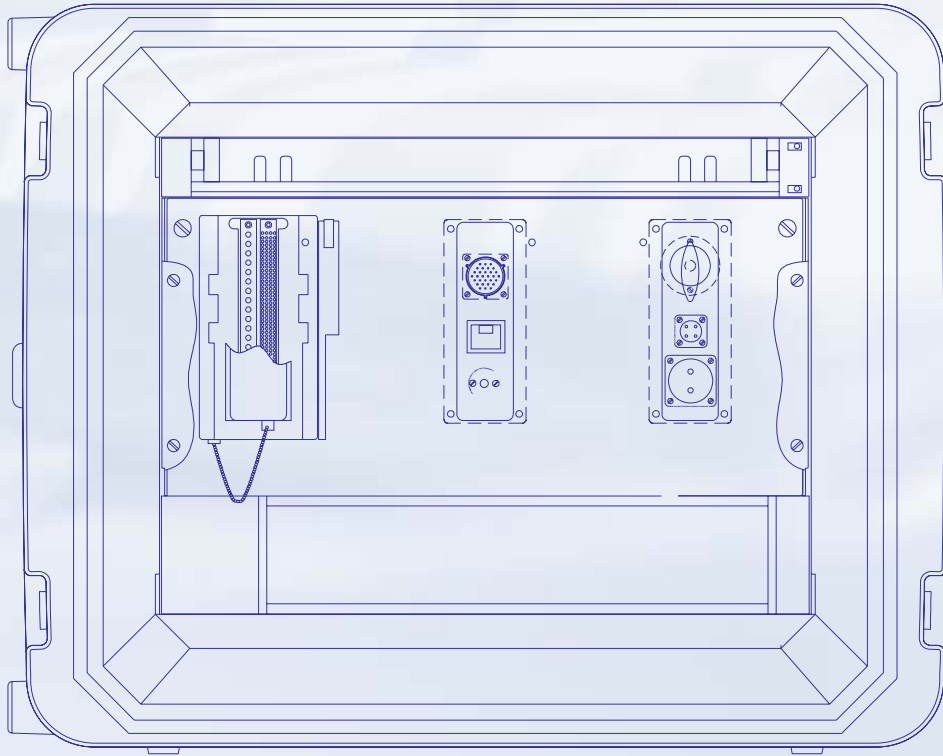
MOBILE ATE is designed to check technical condition and to diagnose both removed and onboard LRUs.

MOBILE ATE can be used together with MOBILE equipment vehicle or individually upon delivery onboard an aircraft.

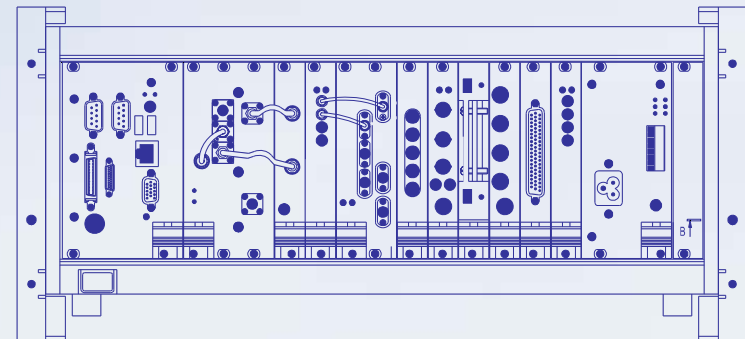
*Testing of LF&RF LRU onboard  
28 VDC & 220 VAC power compatible*

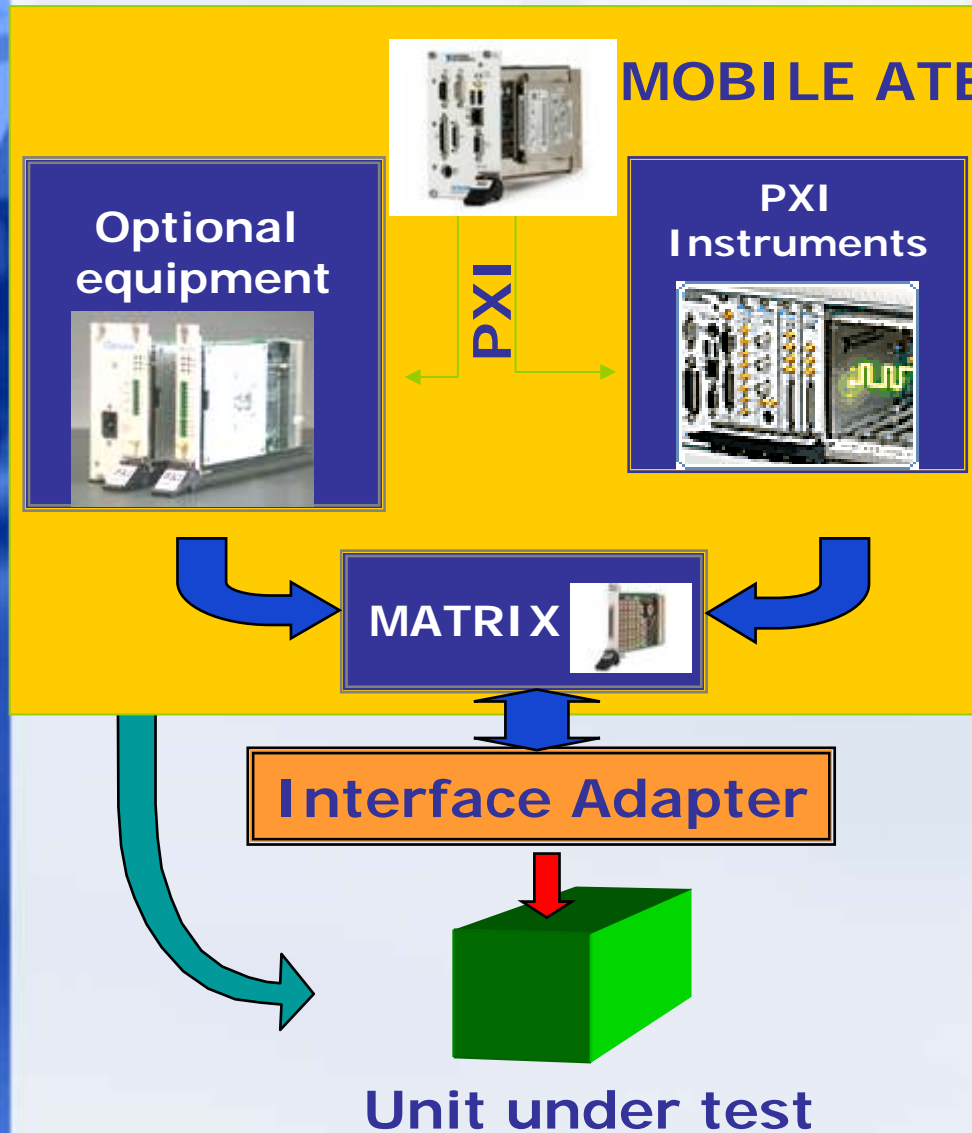


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The system measures LRU parameters and generates necessary signals and commands for LRUs according to the test profile programmed for each LRU. The results of measured LRU parameters are displayed in numeric values.





- PXI instruments
- MATRIX
- Computer



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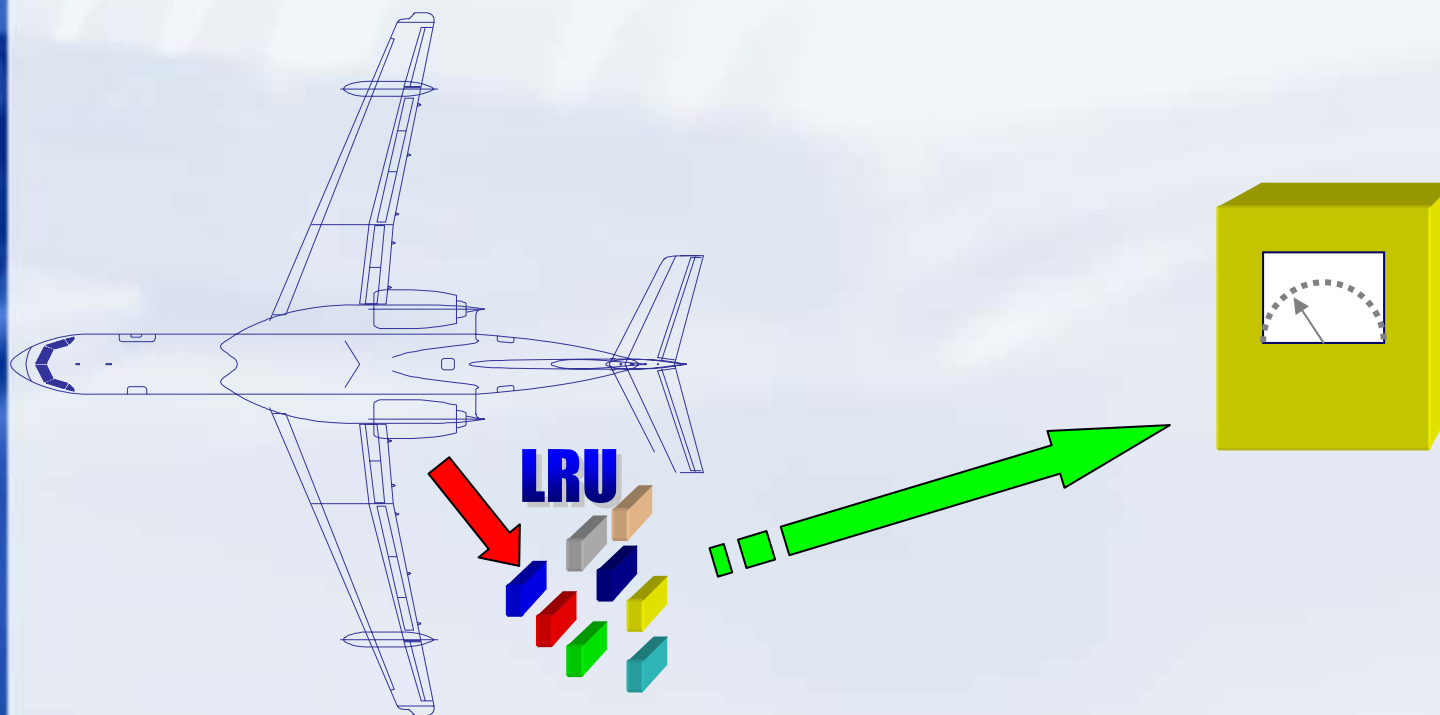


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*80% LRUs are tested onboard*



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Power sources  
Generators  
Digital to Analog  
Converters  
Multimeter  
Oscilloscope  
Arinc-429  
RF devices

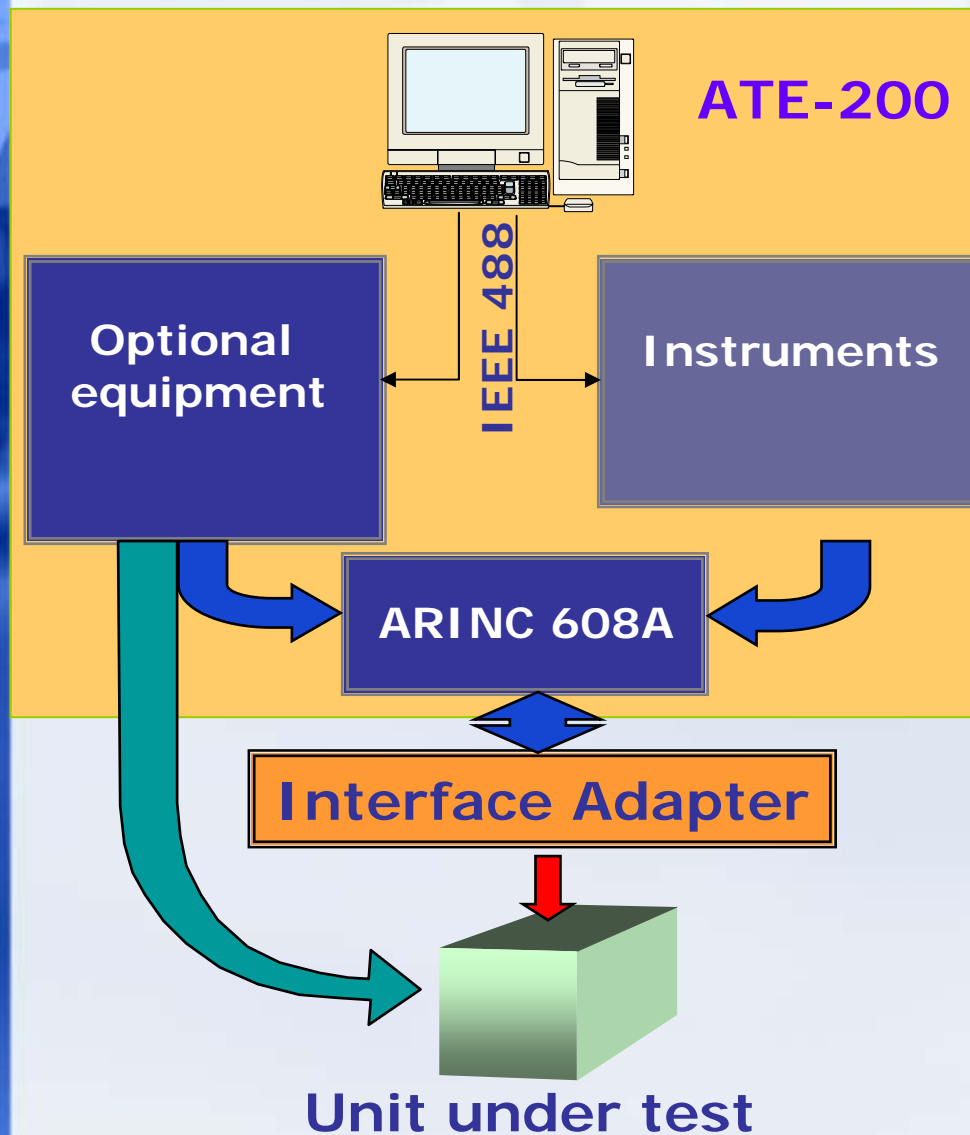
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What is ATE-200?



ARINC 608  
Matrix

ATE-200



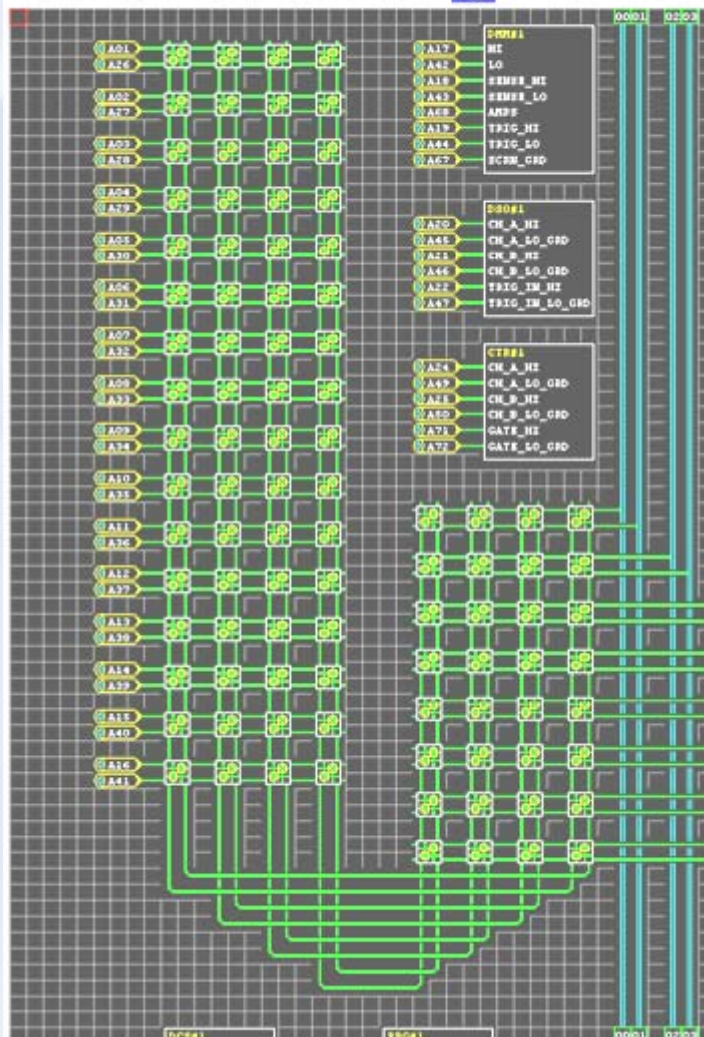
- VXI instruments
- PXI instruments
- IEEE 488 instruments
- ARINC 608A matrix
- Computer



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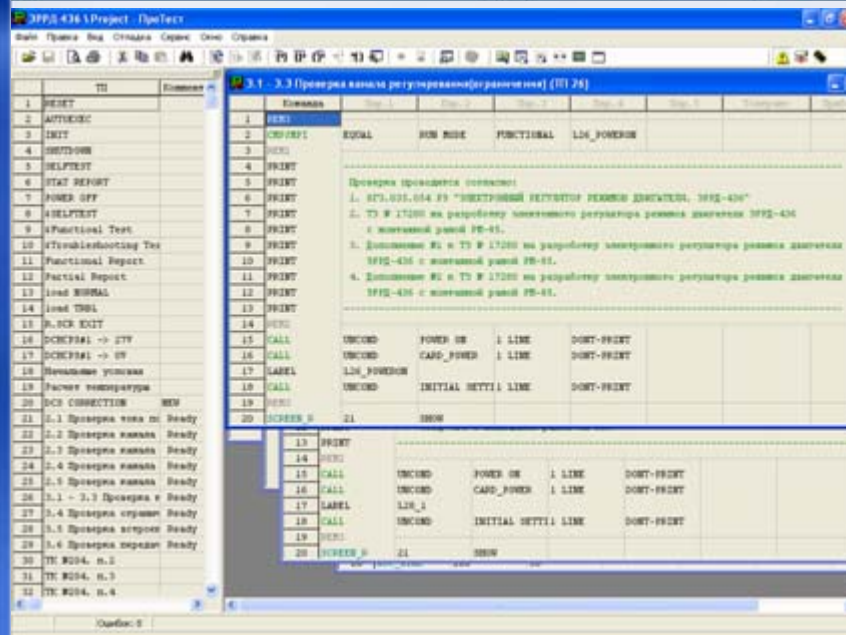
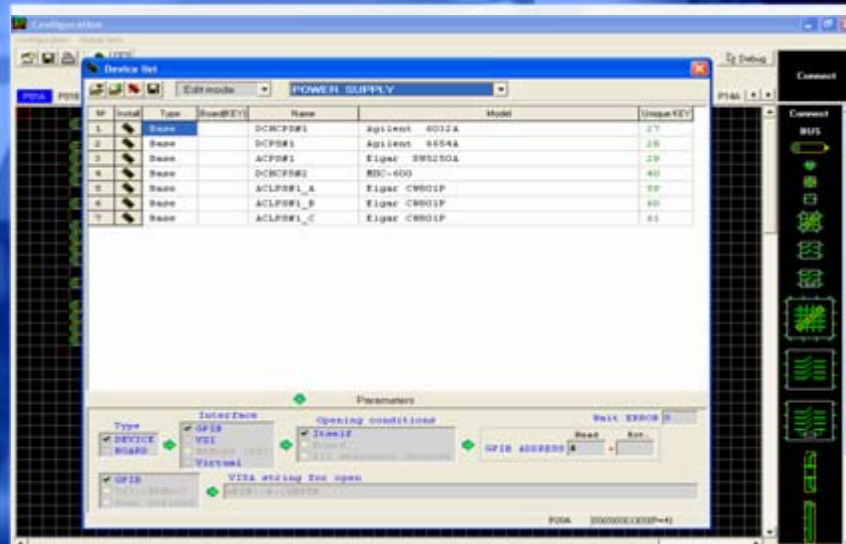
## ATE-200 software – ProTest main subsystems



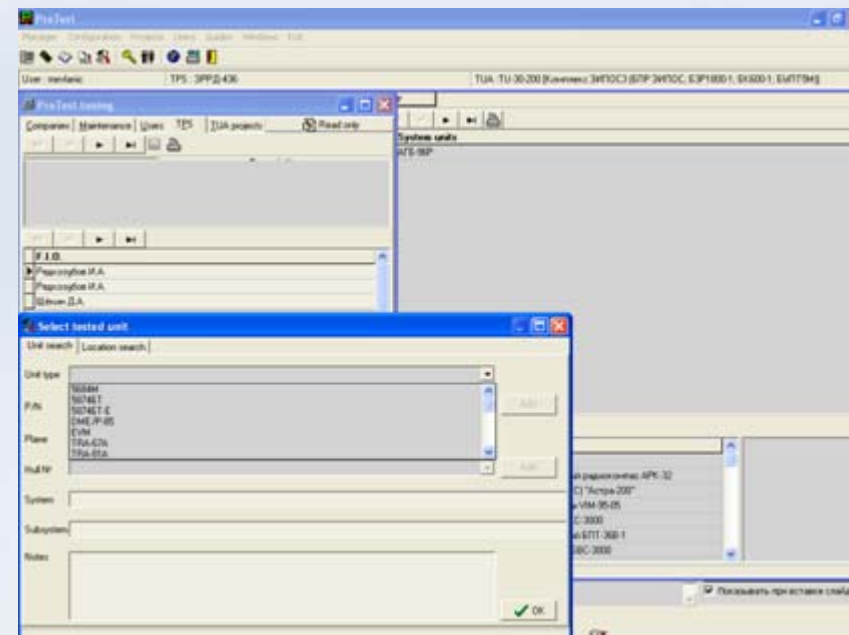
- TPS editing subsystem
- Operator interface editing subsystem
- Instrument control subsystem
- Execution and debug subsystem
- TPS verification subsystem
- ATE-200 configuration editing subsystem
- User administration subsystem
- Operates with NI LabView, C++, and other applications.



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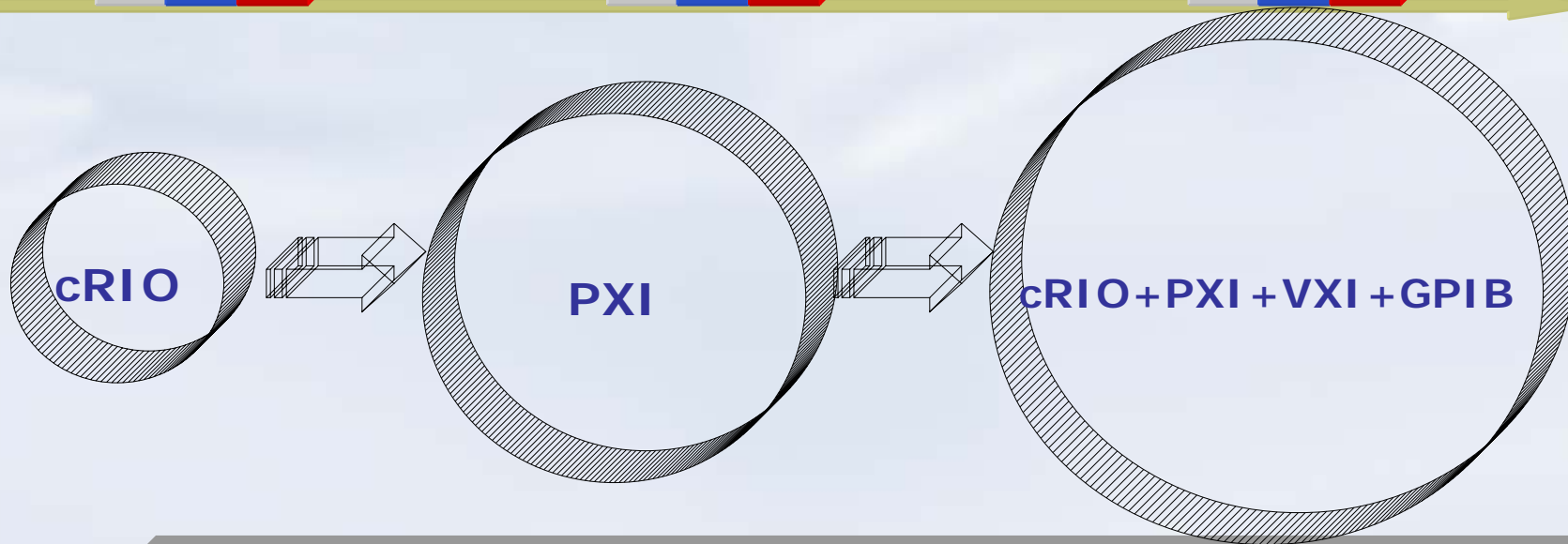
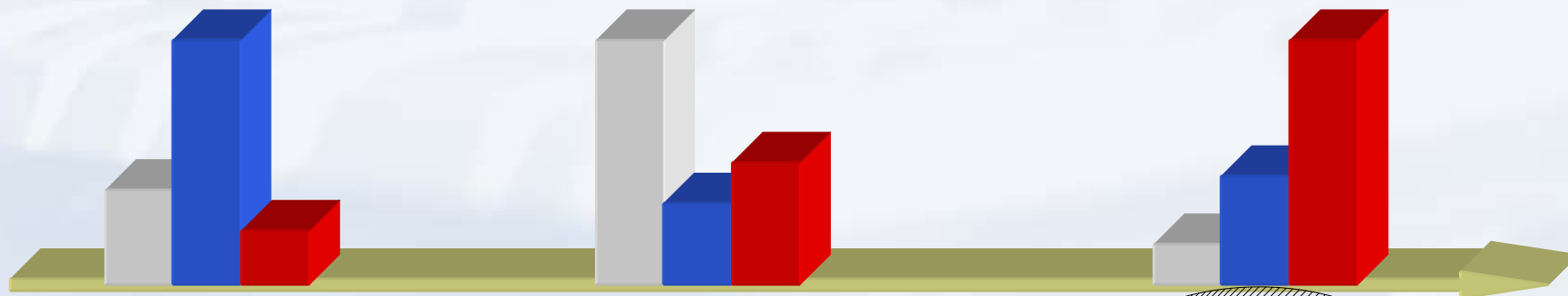


- Facilitates TPS development
- Allows development of structure of new ATE
- Allows electronic logbook keeping





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**Mobility**

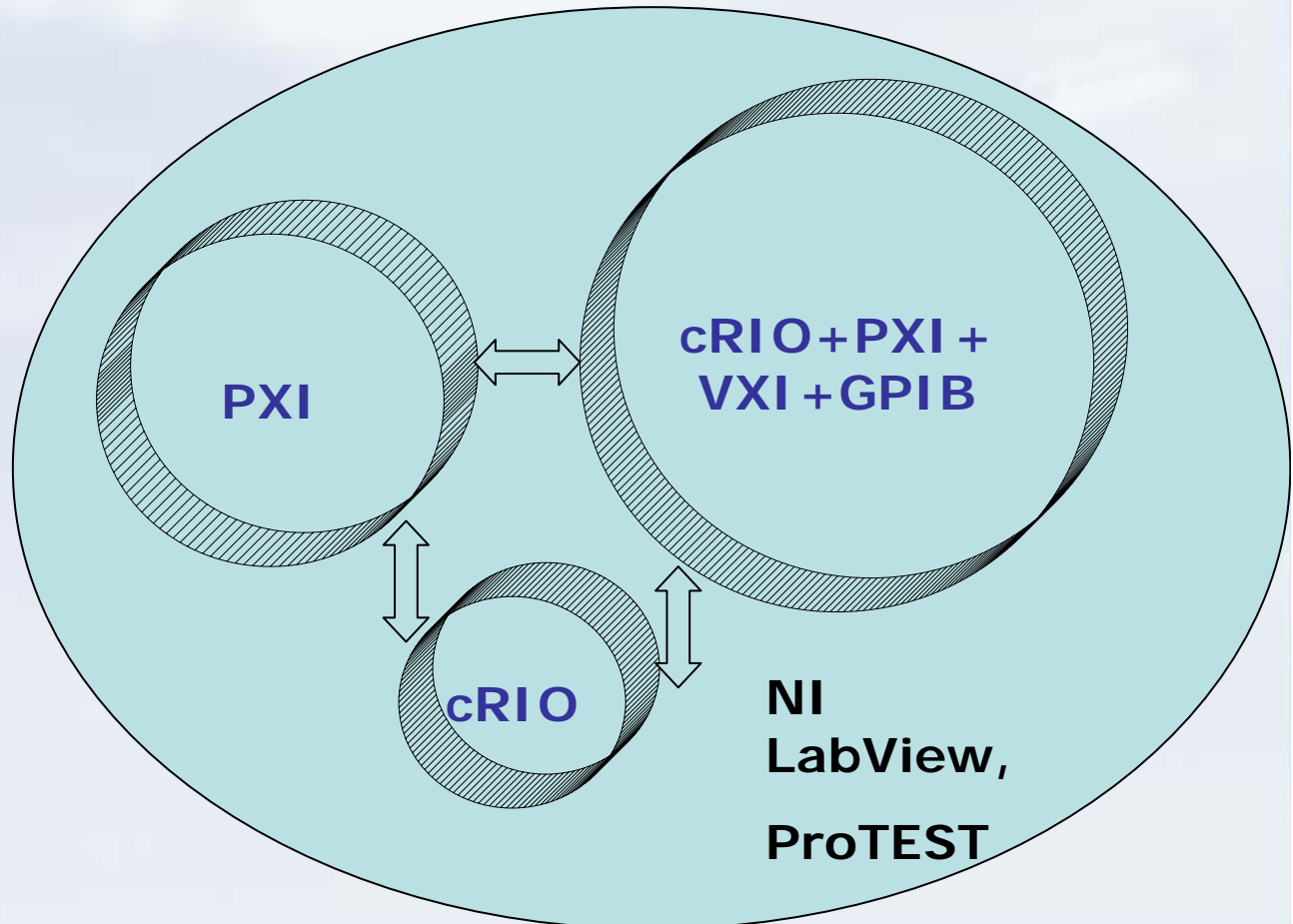
Ability to form complex systems

Number of controlled parameters



## Different types of data and signals are merged in one database

Different types of Test Program Sets are used



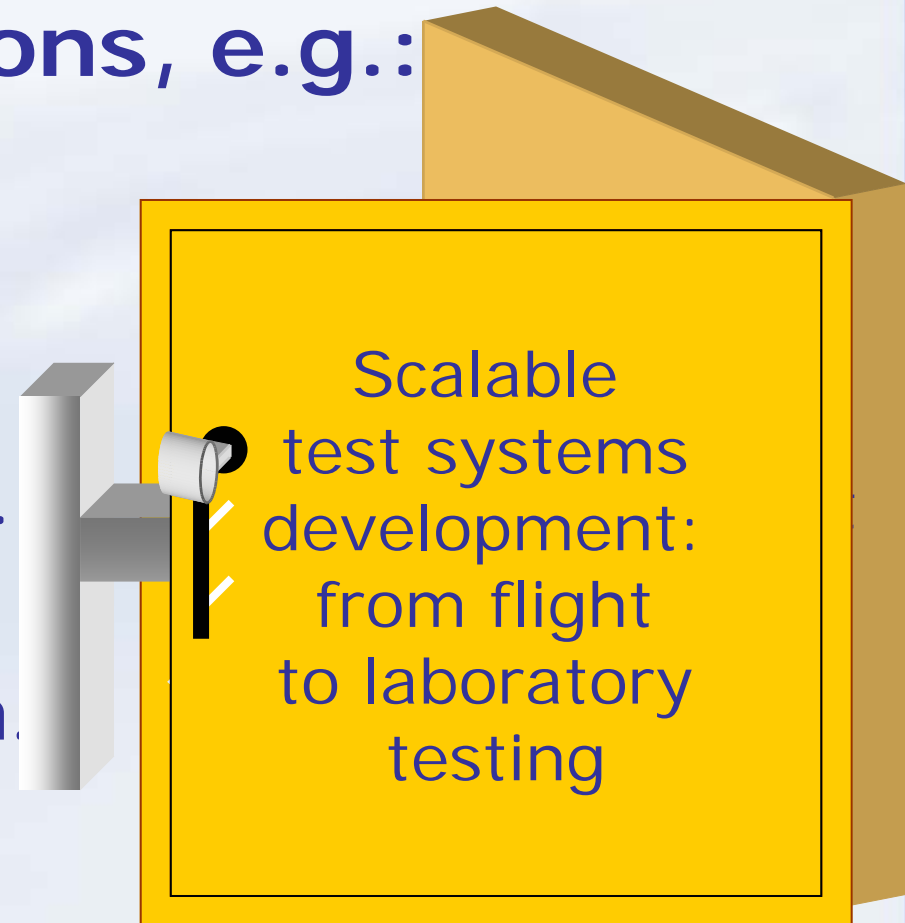


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**These solutions can be easily reconfigured for other applications, e.g.:**

- Maritime solutions.....
- Space research.....
- General transportation.....
- .....



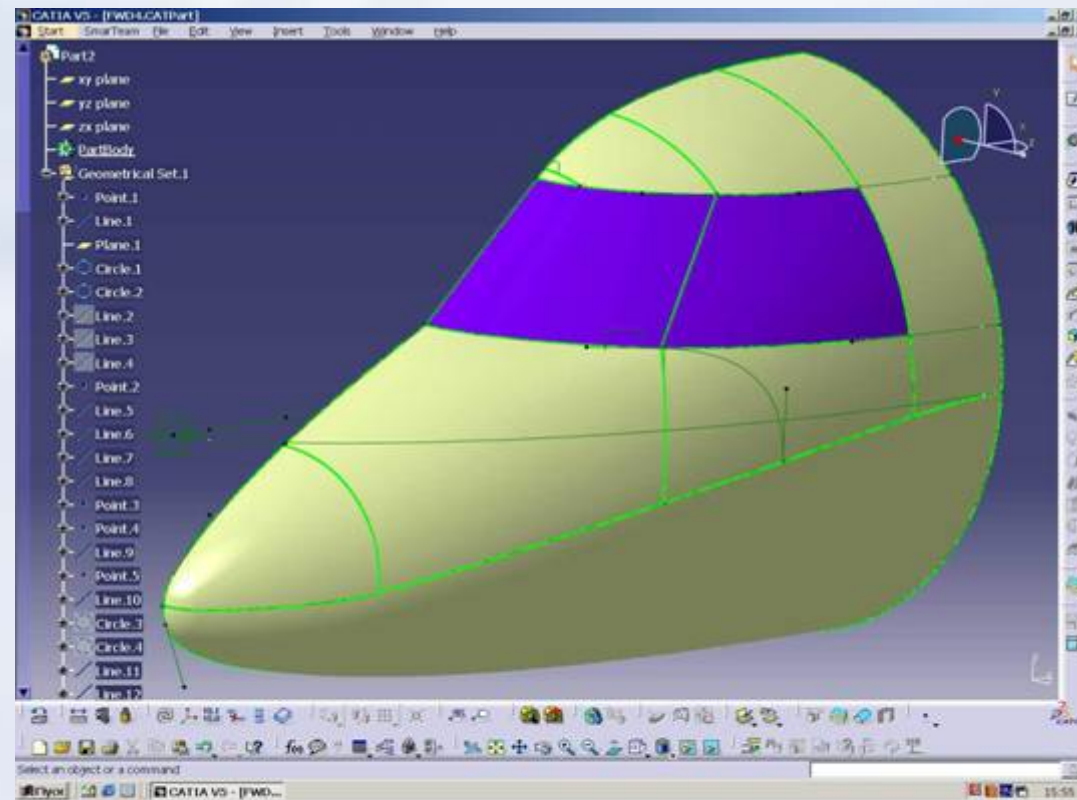


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# Computer-Aided Designing (CATIA)

new direction & new ability





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## **BETA AIR**

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