CK TECHNOLOGIES, INC.(CKT)

INNOVATIVE TECHNOLOGY REDUCES WIRING and HARNESS TEST TIME

Aircraft and Sub Assembly Test Overview

The components of an automatic wiring test solution are:

Test System

Adapter Cables

Test Software

Product (Unit Under Test)

Facts!

- Improving harness testing efficiency = reduced manufacturing costs.

- To accomplish this requires innovative solutions for:
  - more adaptable test system architectures
  - more efficient adapter cable design and build techniques
  - automated test program generation
  - intelligent adapter cable management
  - test management software

- CKT, via extensive development efforts, has become the leader in all these areas.

Systems Circa 1980

- To date many systems on the market have not changed from systems supplied in the 1970's.
- Switching is mounted in large racks.
- Unwieldy control cabling is required to connect the switching matrix to the control console.
- The large physical size of these test systems requires long, cumbersome and extremely expensive adapter cables.

Systems Circa 1980 (continued)

- Adapter cables required can be in excess of 100ft. long.
- Adapter cables have to be routed to all zones of the aircraft.
- Mass of adapter cables are difficult to handle and time-consuming to connect.
- Large numbers of adapter cables are personnel hazards.

Advanced System Architecture

- Designed to eliminate the shortcomings of the large rack systems, CKT developed the first true distributed system.
- Switching matrix can be installed in small portable enclosures.
- Portable enclosures can be placed in close proximity to the assembly being tested, or even inside the fuselage of an aircraft (cockpit, cabin, equipment bays etc.).
- Very short, therefore less expensive and easy to handle adapter cables can be utilized.
- In some cases, adapter cables can be eliminated entirely.
- A single, small-diameter cable connects the switching matrix enclosures to the system controller.

Distributed System Overview

- Portable switching suitcase enclosures are available in 1,000, 1,200 and 1,500 test point capacities.
- Switching can be installed in aircraft compatible LRU enclosures, eliminating adapter cable requirements.
- Switching enclosures can be placed radially up to 500 ft. from the system controller.
- For certain applications, the switching matrix can also be installed in rack style mobile cabinets, with up to 6,000 test points.

Portable Suitcase Switching Units

- DESIGNED FOR USE INSIDE, UNDER AND ON TOP OF THE AIRCRAFT TO BE TESTED
- PERFECT FOR MINIMIZING ADAPTER CABLE LENGTHS
- AVAILABLE WITH 1000, 1200 AND 1500 TEST POINTS

Line Replacement Unit (LRU) Switching Units

- ELIMINATES ADAPTER CABLES
- UP TO 1000 TEST POINTS IN A LRU
- AVAILABLE IN ALL ARINC FORM FACTORS

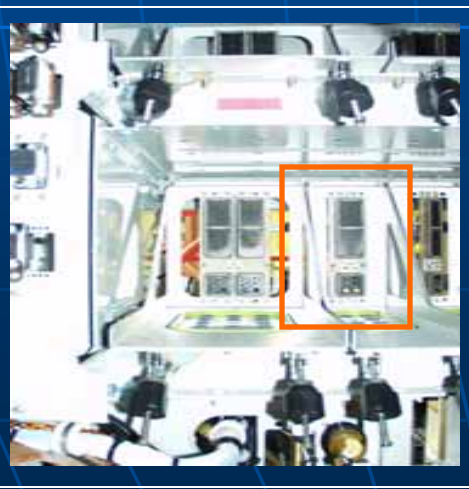
Line Replacement Unit (LRU) Switching Units (continued)

Primarily for testing avionic/electronic racking, though can be configured for “stand alone” connectors

Rear view of electronic rack showing wiring

Front view of rack with aircraft system units installed

Line Replacement Unit (LRU) Switching Units (continued)



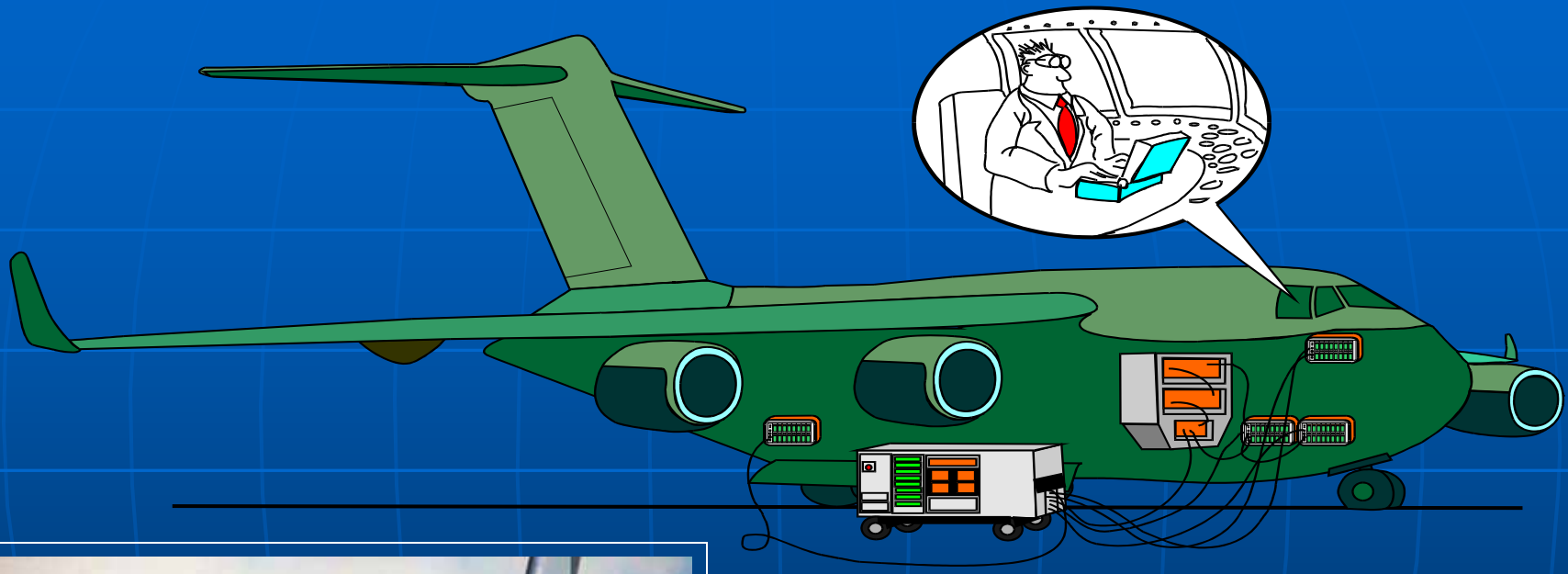
Final Assembly Line Wiring Test Prior To Power-On

LRU CONFIGURED SWITCHING MATRIX

Mobile Switching Cabinet

- DESIGNED FOR MOBILITY AROUND THE WORKSHOP OR INSIDE CABIN
- AVAILABLE WITH UP TO 6,000 TEST POINTS

Critical Systems Wiring Test After Final Assembly



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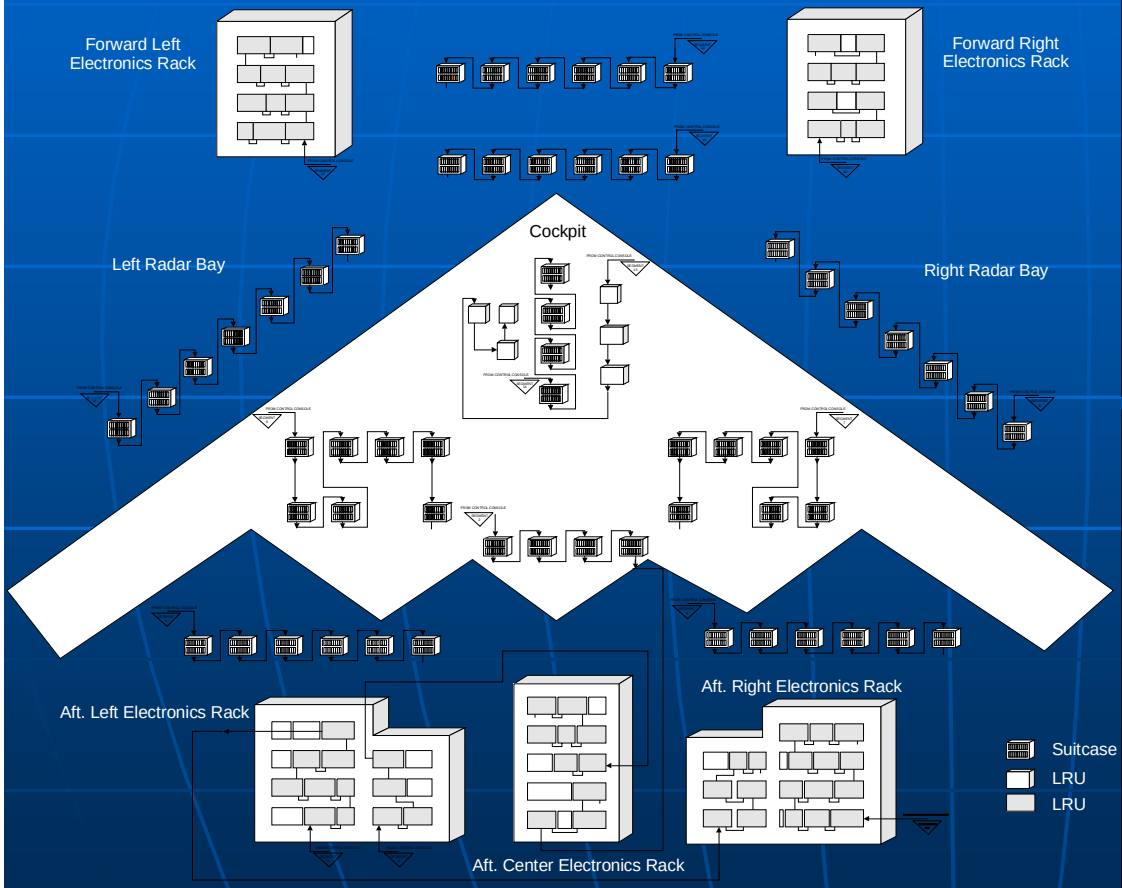
30,000 TEST POINT CKT1175 USING LRU AND SUITCASE SWITCHING UNITS

Total Aircraft Wiring Test At Final Assembly



92,000 TEST POINT CKT1175

Adapter Cable Design

- Legacy systems all utilize one form or another multi-contact adapter cable interface connector, typically 64, 100, 150 contacts.
- Aircraft connectors range from two two several hundred contacts, with the majority having less than 40.
- This mandates either almost all adapter cables will need to be of an “octopus” configuration, or excessive wastage of test system switching points.
- Octopus assemblies comprise a single system connector at one end and two or more aircraft mating connectors at the other.

Adapter Cable Design (continued)

Examples of multi-pin interface connectors used on cable harness test systems.

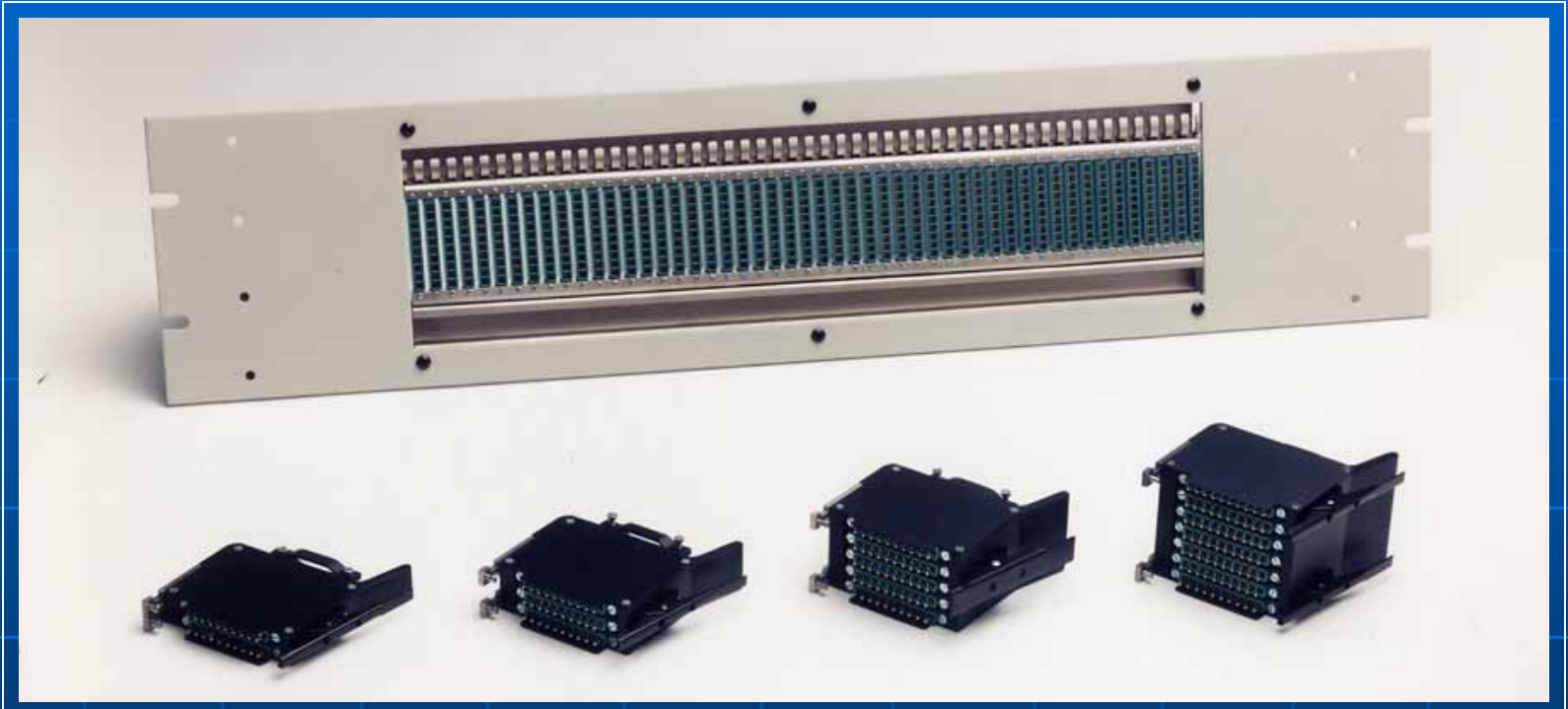
This style of connector usually mandates that adapter cables will have to be on “octopus” design.

Octopus Adapter Cables

Octopus adapters have several disadvantages:

- Complex to design and manufacture
- Prone to damage due to handling, specifically at the junction of the branches
- Branches often require untangling before they can be connected to the unit under test, thereby increasing the most time consuming part of the test process
- Inefficient when it is required to utilize an adapter on more than one product type

Efficient Adapter Cable Design



In 1990 CKT designed a Modular Adapter Connector system (MAC), which revolutionized the design and utilization of adapter cables.

Efficient Adapter Cable Design

One-to-one Adapter Cables

- CKT MAC connectors for adapter cables are available from 10 to 250 pins in 10 pin increments.
- Allows either octopus or one-to-one adapter configuration.
- One-to-one assembly comprises a single cable (no branches) with one system connector and one aircraft mating connector, for instance:
  - 20 pin MAC will be used for a 19 pin aircraft connector
  - 60 pin MAC will be used for a 55 pin aircraft connector
- One-to-one assemblies eliminate the disadvantages of the octopus assembly.

CKT Intelligent Adapter Cable Management System

With all harness test systems, not only must adapters be connected to the correct aircraft connector, but also to a specific switching unit/connector on the test system.

CKT has developed an intelligent adapter cable system, whereby each adapter has a unique electronic identification. This reduces the adapter cabling handling and connect-up time by offering the following capabilities:

- Adapters are stored in intelligent storage cabinets, where they do not need to be stored in a pre-defined location.
- Single or multiple adapters may be easily located.
- Adapters can be connected to any switching unit connector.
- User has a visual indication of when all required adapters have been connected to the switching matrix.

CKT Intelligent Adapter Cable Management System (continued)

- Operator selects Part Number and version of assembly under test.
- Screen displays all adapter cables required for this assembly.
- Status of each cable is graphically represented:
  - in storage cabinet
  - already connected to system switching
  - in transit between cable storage unit and the test system
  - adapter not available (in manufacture, repair etc.)
- Indication of when all required adapter cables are connected to test system.
- Allows for last minute changes due to incomplete product wiring, shortages etc.

CKT Intelligent Adapter Cable Management System (continued)

- Adapter cables required for the aircraft under test will be indicated by a lamp.
- A master lamp will show which cabinets contain required adapters.
- When an adapter cable is removed, drawer lamp will extinguish.
- Cabinets available in several sizes and configurations.
- When adapters are replaced after use, they can be stored in any drawer or cabinet.

CKT Intelligent Adapter Cable Management System (continued)

- Operator either types or speaks serial number of adapter cable into hand held (wireless) path-finder.
- Path-finder displays which aircraft zone (frame, span, level etc.) the relevant aircraft connectors will be found.
- Information displayed to operator can be customized to display any fields in the adapter cable database.

CKT Intelligent Adapter Cable Management System (continued)

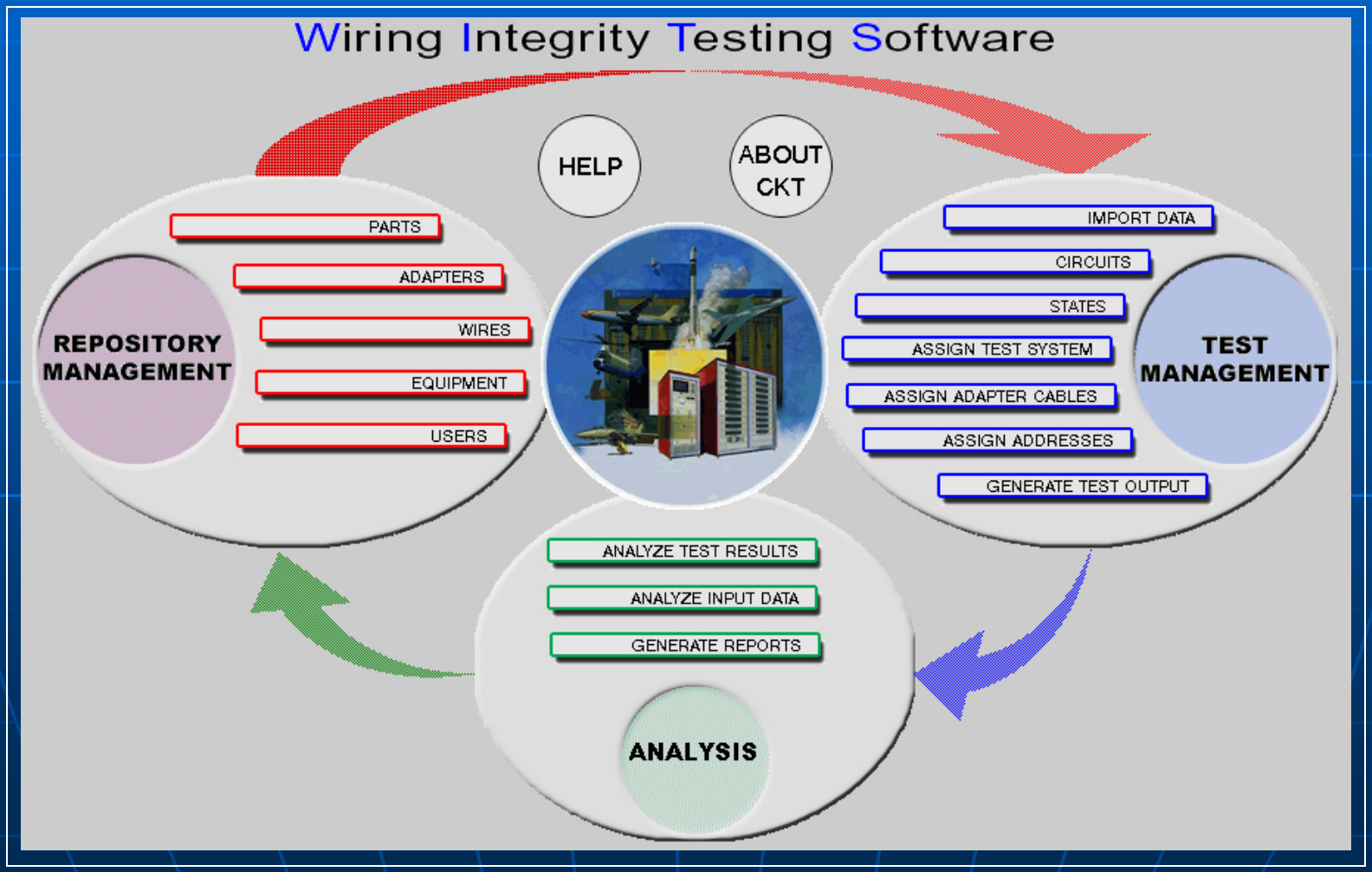
Adapters are connected to aircraft connectors and maybe connected at **any** switching unit connector, resulting in a considerable time saving.

Wireless Test System Control

- Operator PC and system controller are Ethernet connected –wired or wireless.
- Adapter cable storage cabinets and path-finders operate wireless.
- Operator PC can be a desktop, notebook, tablet or hand-held device.
- Wireless system operation provides true remote control, particularly useful when diagnosing test report or performing manual tests at rework time.

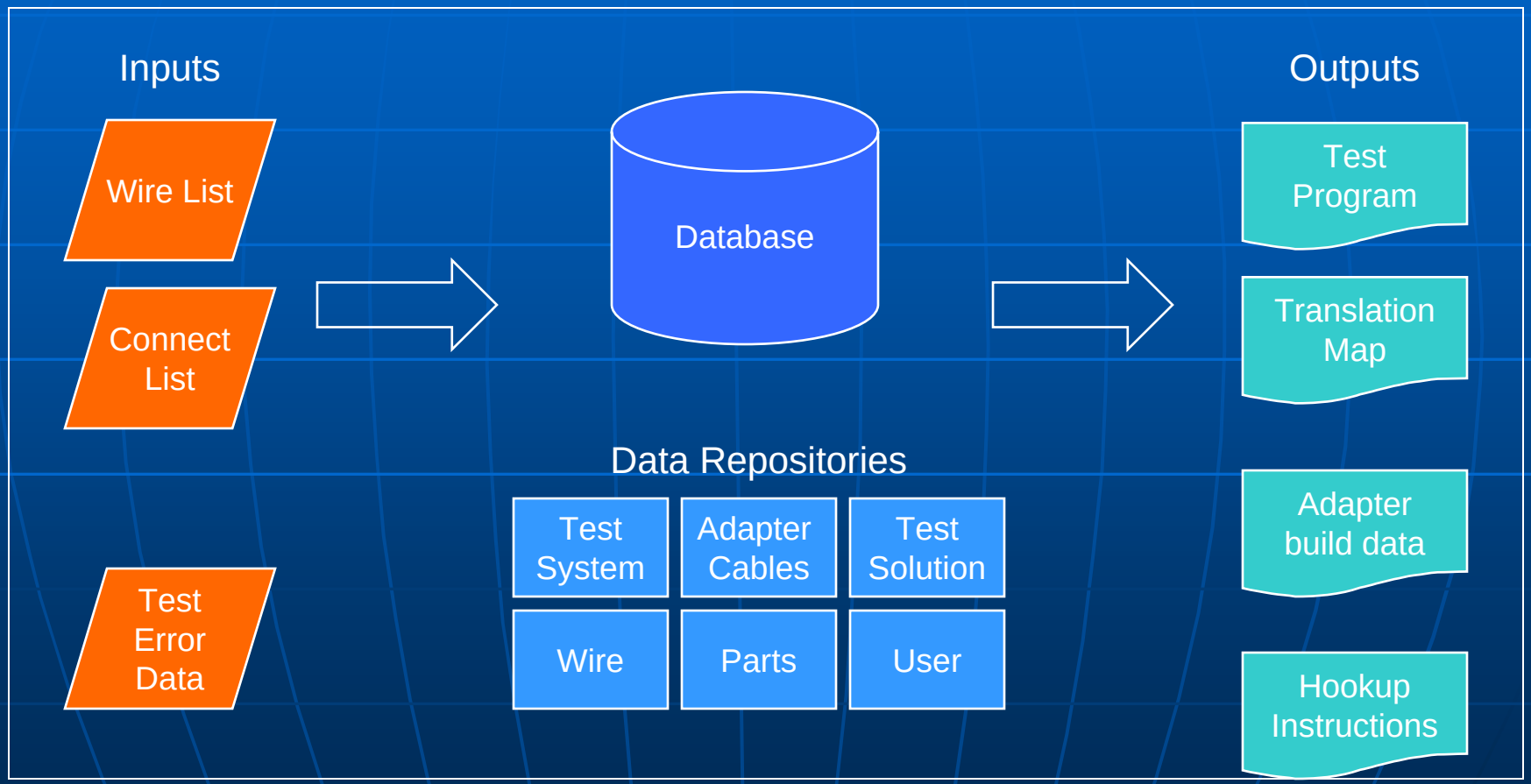
Wiring Integrity Testing Software –WITS

Total Test Management



Wiring Integrity Testing Software

WITS Database Overview



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CK TECHNOLOGIES, INC.
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INTERCONNECTION TESTING
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Thank You !

CK TECHNOLOGIES, INC. - The Wiring Analysis Company

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