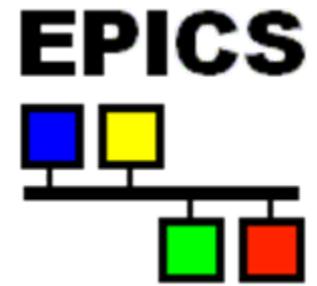
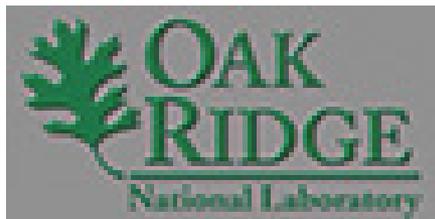


Oscilloscopes for Particle Accelerators



Geoff Hoekstra - Regional Sales Manager
ZTEC Instruments

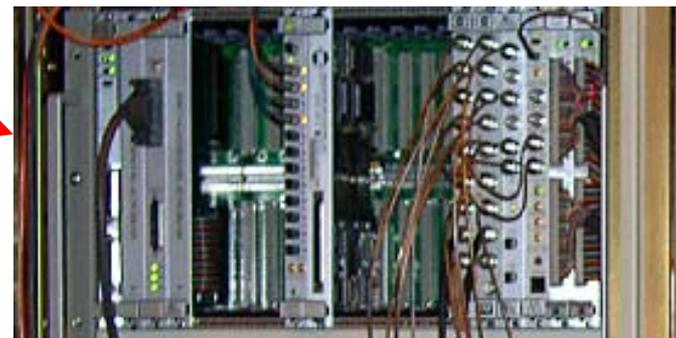
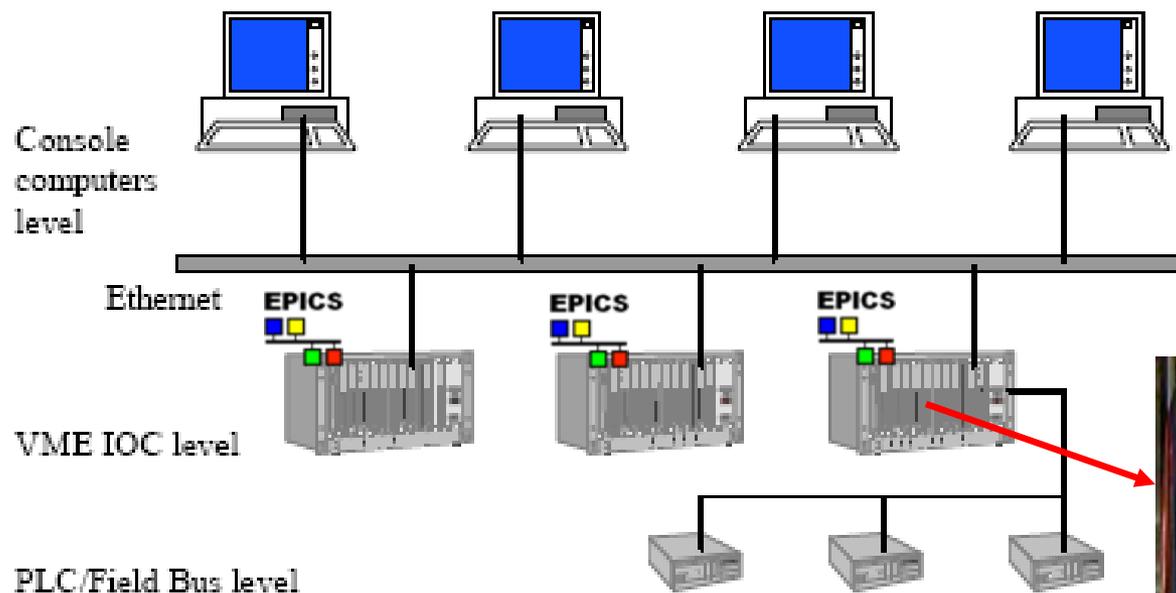


Agenda

- Oscilloscopes for particle accelerators
- ZTEC's particle accelerator solution
- Responsive remote access
- The ZT4610 EPICS oscilloscope
- ZTEC instrument overview
- About ZTEC



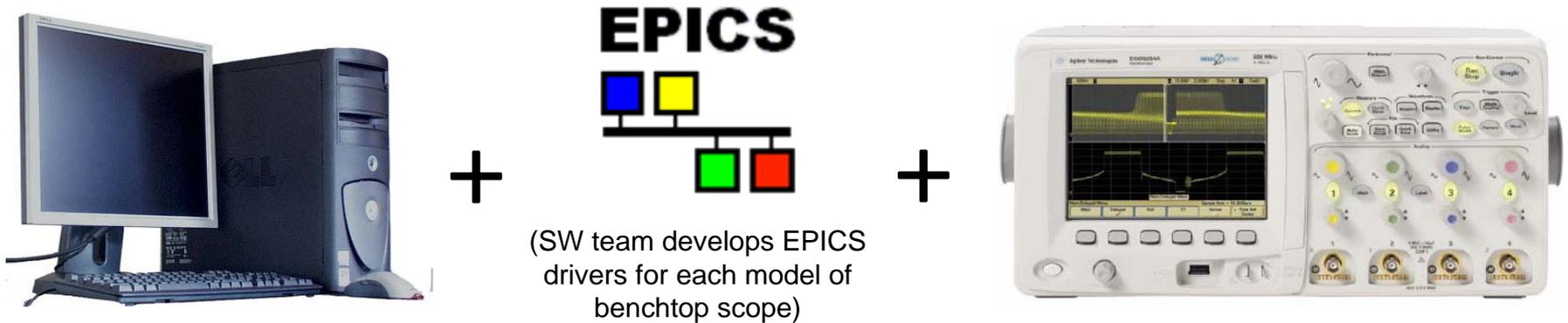
Oscilloscopes for Particle Accelerators (Using VME, VXI, PXI, etc.)



- **Advantage:** high channel density
- **Disadvantages:** requires multiple controllers (\$), limited choices for high-performance scope modules (mostly digitizers), ...



Oscilloscopes for Particle Accelerators (Using benchtop scopes)



- **Advantage:** wide selection of benchtop instruments at various performance and price levels
- **Disadvantages:** requires a PC-based IOC (\$), very low channel density, requires EPICS drivers (development time & \$), slow remote response, scope models frequently change, ...



Oscilloscopes for Particle Accelerators (With embedded EPICS IOC)



- **Advantages:** external IOC not required, high channel density, responsive remote control, fast remote display updates, high performance signal acquisition (scopes, not digitizers)
- **Disadvantage:** initially available only as a performance (1 GHz) scope
[* In 2008 ZTEC will introduce precision (14 or 16-bit resolution) and economy (lower-price) EPICS oscilloscopes]



ZTEC's Particle Accelerator Solution

Oscilloscope Monitoring & Control...

...at the Beamline

Use ZScope software to view waveforms, control instruments, download data, etc.



...in the Control Room

Embedded IOC enables EPICS users to monitor and control the oscilloscope



...from Anywhere

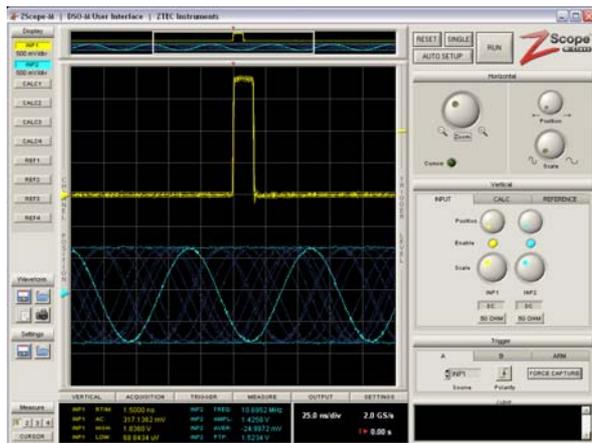
Use free viewer software to access instruments via the internet



ZTEC's Particle Accelerator Solution

Oscilloscope Monitoring & Control at the beamline

- Connect to ZTEC's EPICS scopes via LAN or USB
- Use ZScope software for control, waveform display, saving data, etc.
- Drivers for LabVIEW, CVI, ...
- Easily import acquired waveform data into MATLAB



Free ZScope display and control software



Installed Oscilloscopes



...in the Control Room

Embedded IOC enables EPICS users to monitor and control the oscilloscope



...from Anywhere

Use free viewer software to access instruments via the internet

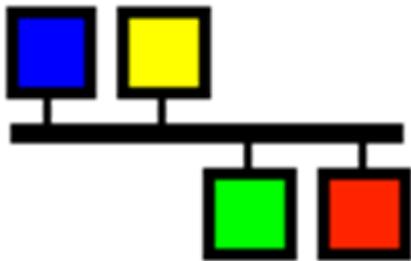


ZTEC's Particle Accelerator Solution

Oscilloscope Monitoring & Control in the control room

- Embedded IOC enables EPICS users to monitor and control the scope
- Scope publishes PVs to EPICS database using CA protocol

EPICS



...at the Beamline

Use ZScope software to view waveforms, control instruments, download data, etc.



LAN/USB

or

802.11



Installed Oscilloscopes



...in the Control Room

Embedded IOC enables EPICS users to monitor and control the oscilloscope



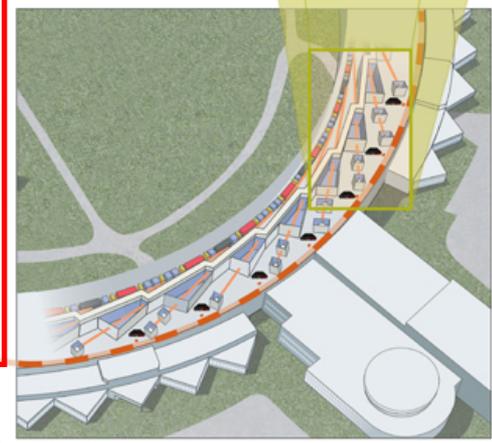
LAN

...from Anywhere

Use free viewer software to access instruments via the internet



Internet



ZTEC Confidential



ZTEC's Particle Accelerator Solution

Oscilloscope Monitoring & Control from anywhere

- Access the instrument from any internet connection (*Administrators can define who has access to the scope*)
- ZScope software provides responsive remote updates
- Built-in web server shows instrument information, LAN configuration, and more

...at the Beamline

Use ZScope software to view waveforms, control instruments, download data, etc.



Installed Oscilloscopes



...in the Control Room

Embedded IOC enables EPICS users to monitor and control the oscilloscope



...from Anywhere

Use free viewer software to access instruments via the internet



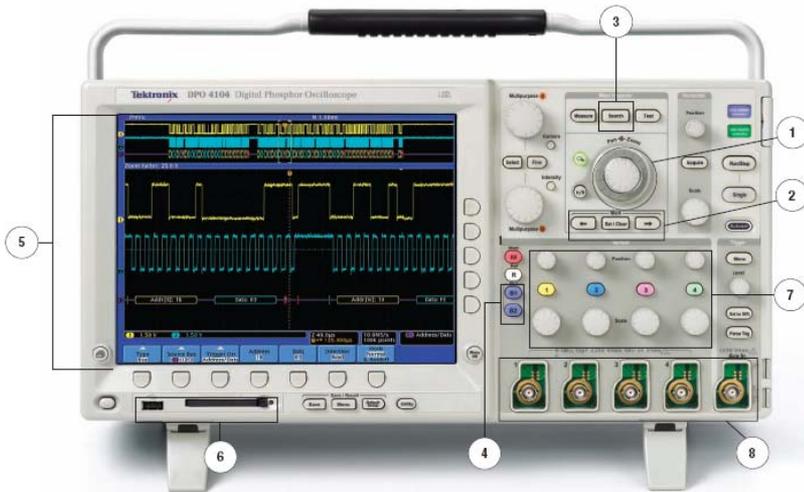
Responsive Remote Access (1)

ZTEC protocol decreases network traffic and increases remote instrument responsiveness

- Results in ~10x increase in waveform updates and instrument control responsiveness, compared to benchtop scopes
 - Compression and waveform rasterization dramatically decreases network traffic
- When needed, all waveform data can be saved

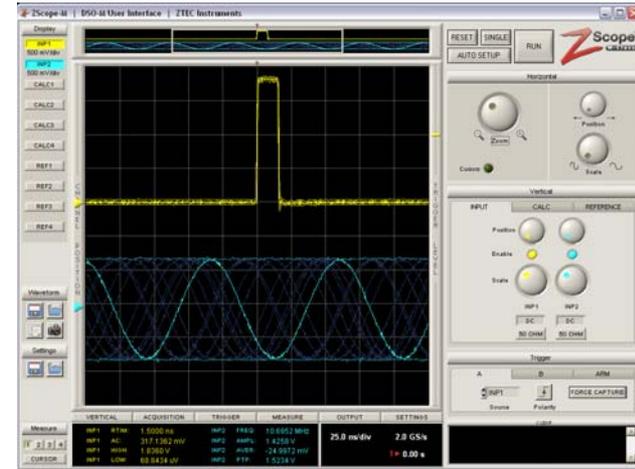


Responsive Remote Access (2)



**Tek DPO4034
(web browser over LAN)**

- 1 display update every 2-3 sec



**ZT4610 EPICS scope
(ZScope over LAN)**

- 4 display updates every sec
(~10x faster than Tek!)





ZT4610 EPICS Overview

ZT4610 EPICS Scope Advantages

- The ZTEC 4610 EPICS Oscilloscope provides:
 - Easy, intuitive and responsive control
 - Directly control all instrument features via USB or LAN (just like a benchtop scope)
 - Complete EPICS compatibility, thanks to an embedded IOC
 - Responsive remote monitoring via the Internet
 - High-performance signal acquisition (details on next slide)
 - Custom control and display using LabVIEW, LabWindows, ...
 - Easy data transfer to MATLAB and other applications
 - Portable for on-the-spot troubleshooting



Advanced Signal Acquisition

- A full-featured performance digital oscilloscope
 - Fast sampling (max 4 GS/s real-time sample rate)
 - 1 GHz analog bandwidth
 - Long memory (up to 64 Msample record lengths)
- 2 or 4 input channels
- Fast acquisition
 - Trigger re-arm in <5 μ s
- Capture, view, overlay and save up to 32,000 waveforms using segmented memory
- Reduce random noise by averaging up to 64,000 waveforms





ZTEC Instrument Overview

Performance, Precision and Economy Scopes

PERFORMANCE OSCILLOSCOPES
in PCI, PXI, & VXI



| | | | |
|-----------------|-------------------|-----------------|-----------------|
| 4 GS/s 8-Bit | 2.5 GS/s 8-Bit | 2 GS/s 8-Bit | 1 GS/s 8-Bit |
|-----------------|-------------------|-----------------|-----------------|

**Performance
EPICS/LXI scopes:
Dec 2007**

PRECISION OSCILLOSCOPES
in PCI, PXI, & VXI



| | | |
|--------------------|--------------------|--------------------|
| 400 MS/s 16-Bit | 500 MS/s 14-Bit | 200 MS/s 12-Bit |
|--------------------|--------------------|--------------------|

**Precision EPICS/LXI
scopes: Q2 2008**

ECONOMY OSCILLOSCOPES
in PCI, PXI, & VXI



| | |
|-----------------|--------------------|
| 1 GS/s 8-Bit | 200 MS/s 12-Bit |
|-----------------|--------------------|

**Economy EPICS/LXI
scopes: Q1 2008**

ZTEC Confidential

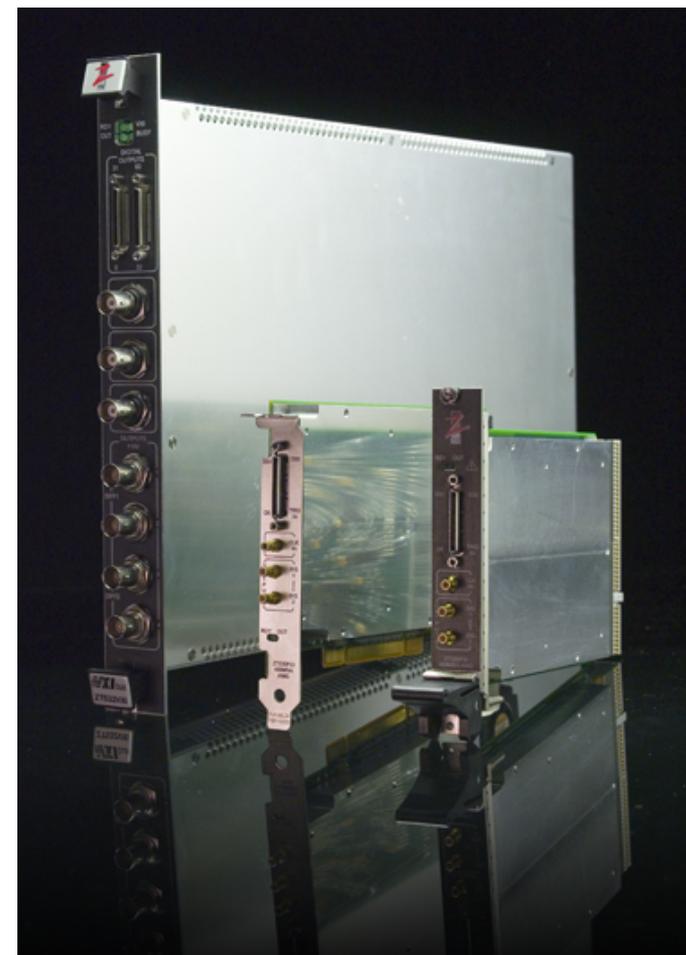
Function / Arbitrary Waveform Generators

C-Class

- 530 Series
 - 16-bit
 - 400 MS/s
 - VXI, PXI, and PCI

M-Class (*coming in 2008*)

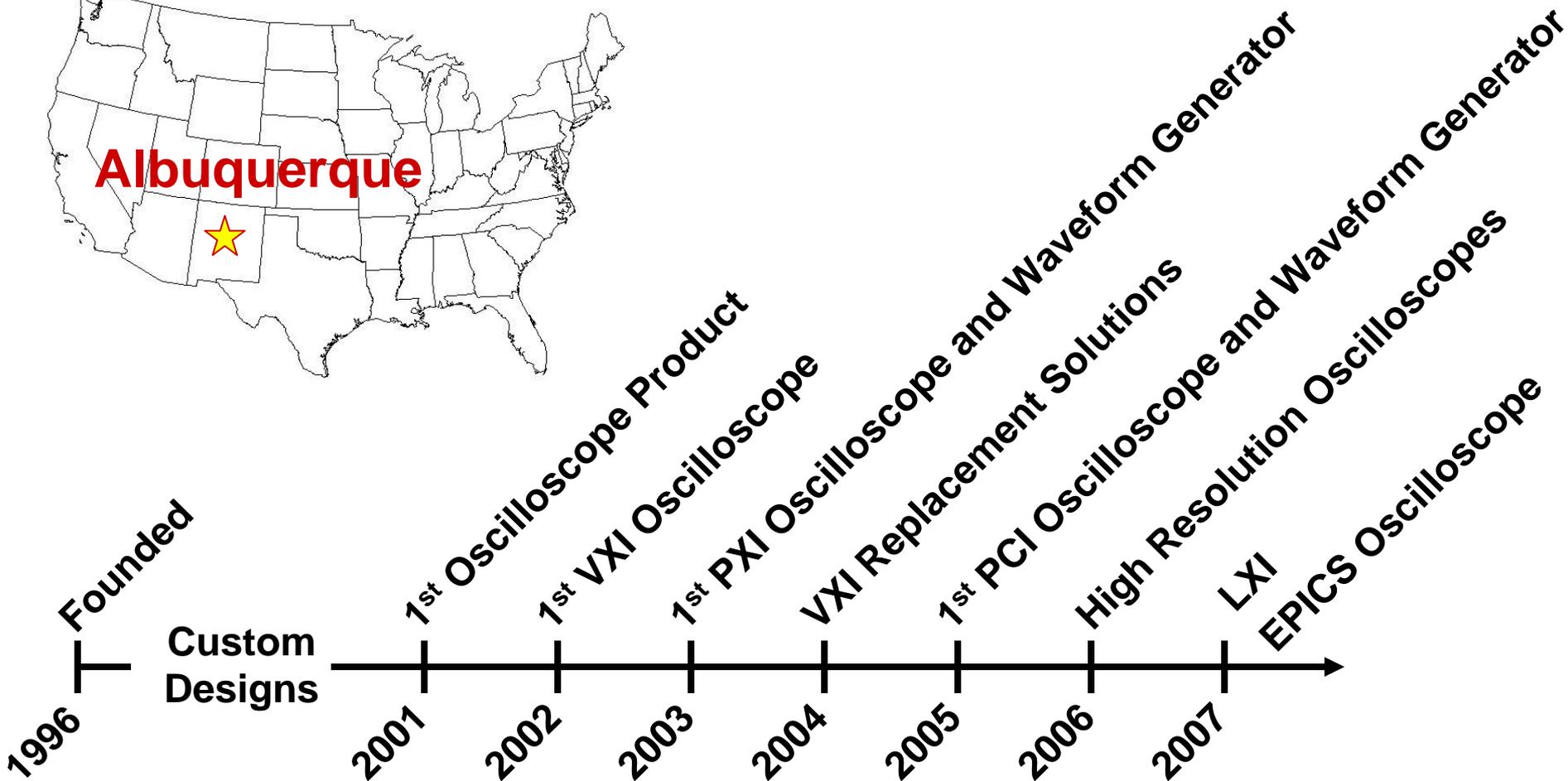
- Performance ZT5610
- Precision ZT5410
- Economy ZT5210
- PCI, PXI, VXI, LXI/EPICS





About ZTEC

ZTEC's History



ZTEC's Industry Breadth

ADVANTEST

GENERAL DYNAMICS

Strength on Your Side™

 Sandia National Laboratories

Honeywell

LOCKHEED MARTIN
We never forget who we're working for™

 **JDS Uniphase**

BAE SYSTEMS

 **Medtronic**
When Life Depends on Medical Technology

KEITHLEY
A GREATER MEASURE OF CONFIDENCE



SPAWAR
Transforming Information Into Decisive Effects

NAVSEA
WARFARE CENTERS

LCE

MIT

 **Fermilab**

 **U.S. AIR FORCE**
CROSS INTO THE BLUE

B & B
Technologies, Inc.
Integrating the Future


BOEING
Forever New Frontiers

ManTech
International Corporation

 **Penn**
UNIVERSITY OF PENNSYLVANIA

Georgia Institute of Technology

Auti

 **Los Alamos**
NATIONAL LABORATORY

NORTHROP GRUMMAN

TERADYNE

credence

 **Marines**
The Few. The Proud.

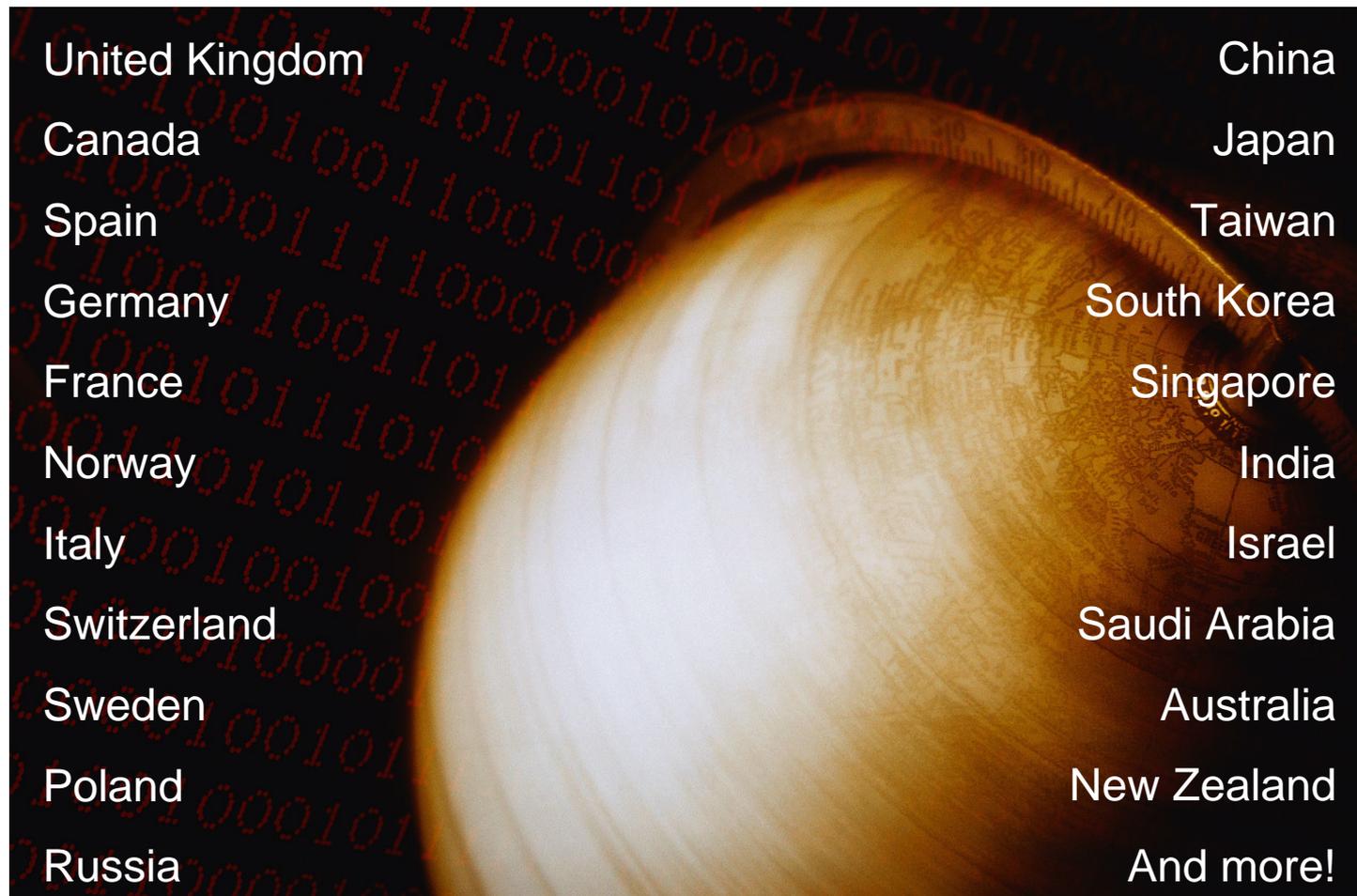
NAVY
accelerate your life.

NAV AIR

Raytheon

dme
CORPORATION

ZTEC's Global Reach





Questions?