

CLEMSON

UNIVERSITY



COLLEGE OF THE YEAR

Public University ■ **CLEMSON UNIVERSITY**





Center for Research in
**Wireless
Communications**



Wireless Growth

- Handset applications rising exponentially
 - Multi-media, up to full-motion TV
 - Replacing credit cards
 - Becoming mobile-workers input/output tool
- Wireless expansion of Cellular with Ad-Hoc/Mesh Nets
- Inventory, Material Management Increasing
- Perimeter Security, Personnel Tracking
- Telematics (vehicle systems) Growth
- RFID Applications, etc., etc., etc.

= Wireless Explosion!

A Selection of Current Activities

- **Energy-Efficient Routing of Multimedia Traffic**
 - Software for 3G, 4G, later
- **Turbo Coding**
 - Software for increasing transmission speeds with less power required for all future multi-media transmissions
- **Distributed Scheduling Protocols in Ad Hoc Networks**
 - Software for expanding wireless networks without fixed towers

Current Activities, Continued

- **Network Behavior Exploiting Directional Antennas**
 - Software and hardware to increase number of users, reduce vulnerabilities
- **Hyper Bandwidth Antennas**
 - Software & Hardware for future systems
- **Electromagnetic Penetration into Complex Metallic Enclosures**
 - Hardware to make future wireless systems more useful in complex structures



Current Activities, Continued

- **Transmitting Antennas with Digital Beamformers**
(low-cost multi-beam antennas) -
Software & Hardware for late 3g, 4g, Later
- **Waveform Optimization for Ultra-Wideband Communications**
 - Software & Hardware for future systems
- **Multiple Access Ultra-Wideband Systems**
 - Software/Hardware Applicable to all future systems

Indications of Strength—sponsorship:

- Research Funds Awarded in Last 10 Years
\$19,969,682 (all competitive)
- State of South Carolina Funding:
\$1million/year (Above Salaries)
- Industrial Partner Funding
\$500⁺k/year (Goal)

Present Funding

- By State of South Carolina:
Faculty Salaries.
- Three Center principals occupy faculty chairs – Private and State Funding
- Research Funds under present and expected programs = \$2Million/Year

Immediate Goal

Establish Clemson University as a
National Science Foundation
Engineering Research Center
in
Wireless Communications

— window opened April 2004

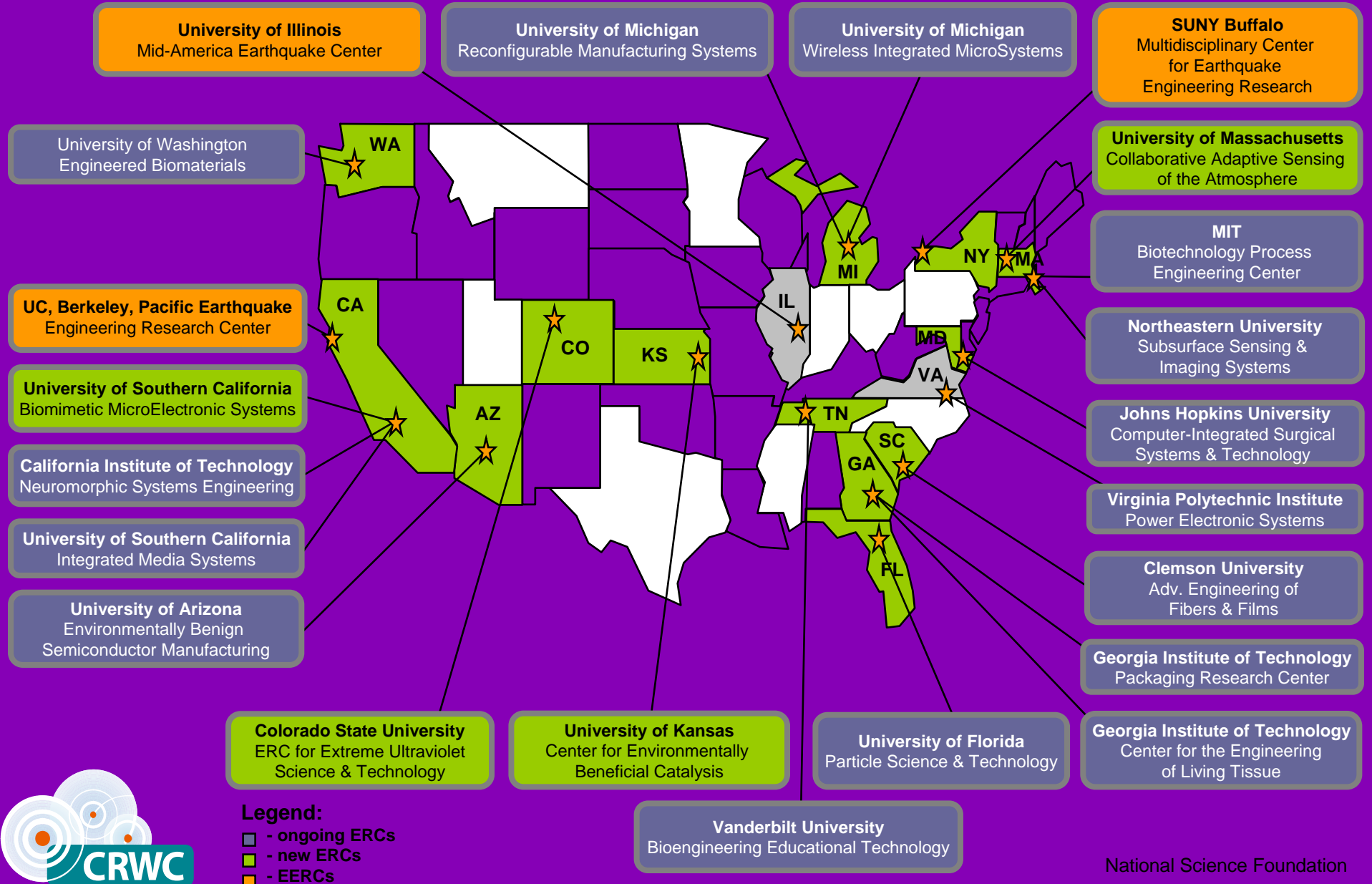


Meaning:

An
International Resource
At
Clemson University!

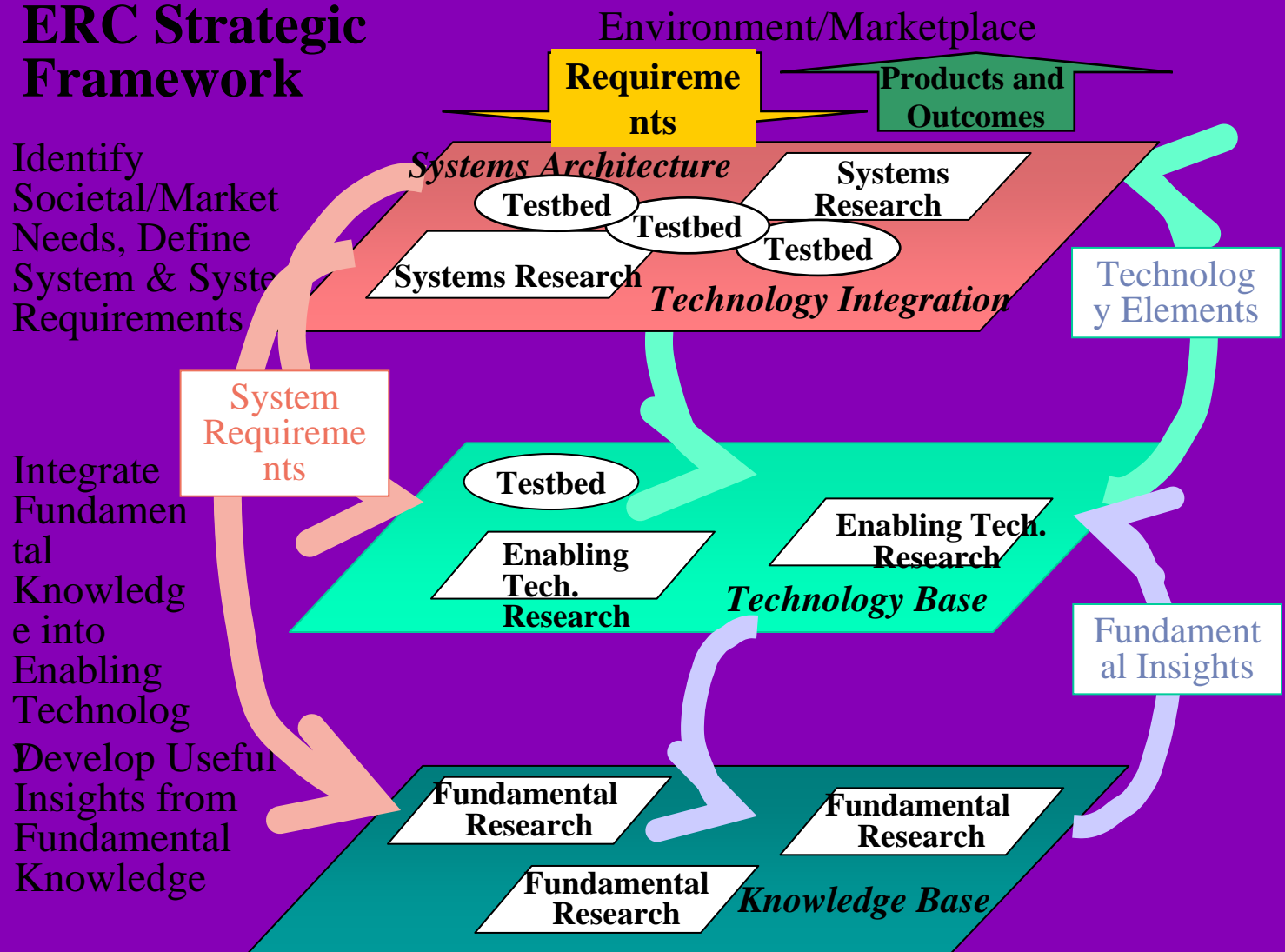


Current Engineering Research Centers



ERC's Are Set Up to Have Industry Requirements Guide Research

ERC Strategic Framework



Team-Mate Institution

University of California
At
San Diego



UCSD Strengths:

- Complementary to Clemson University
- California Institute for Telecommunications & Information Technology
- Center for Wireless Communications
- Strong Existing Industrial Program



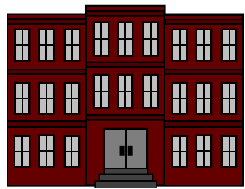
Two Linked Activities

Core research program
(CU & UCSD).

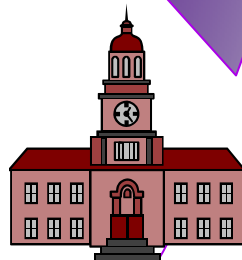


Research Program for
Emerging Engineered
System

- Dynamic spectrum allocation
- Software radio
- Advanced ad hoc networking
- Advanced adaptive antennas



Broader Impact Activities



Linkage/outreach to minority
and female institutions
intended to bring
underrepresented groups into
engineering and science fields.

Who We Are:

- A primary source of basic research in wireless communications for the Department of Defense
- Evolved from Center for Computer Communications Systems (state-chartered 1990)
- Structurally, CRWC Comprises Two Groups:
 - Wireless Communications Systems & Networks
 - Applied Electromagnetics



Who We Are: Participating Faculty

Wireless Communication Systems and Networks

Carl
Baum



Dan
Noneaker



Mike
Pursley



Harlan
Russell



John
Komo



Joe
Hammond



Martha
Steenstrup



Antennas & RF Systems

Anthony
Martin



Chalmers
Butler



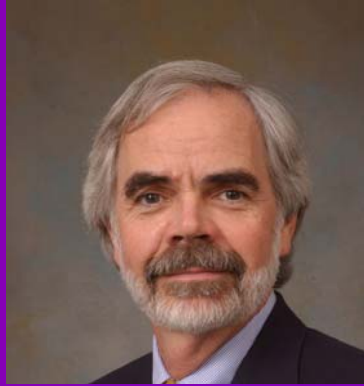
Wilson
Pearson



Fred
Tesche



Leadership:



Mike Pursley
Spread-Spectrum
Performance Modeling



L. Wilson Pearson
Director



Chalmers Butler
Electromagnetic Structures
(Antennas)



Staff



Serita Acker
Higher Education
Liaison Officer



Tom Rogers
Education Liaison
Officer



Jim Jones
Industrial
Liaison Officer



Amanda Leslie
Administrative
Coordinator

Indications of Strength—recognition:

- Participation in 3 DoD MURI programs (leadership in 2)
- One DoD Focused Research Initiative
- NSF Career Awardee
- Numerous Best Paper Awards
- Four IEEE Fellows
- IEEE Centennial Medal
- Four recipients of IEEE Third Millennium Medal
- Chen To Tai Award Distinguished Educator Award (IEEE Antenna & Propagation Society)
- E.H. Armstrong Achievement Award (IEEE COMSOC)

ERC NSF Funding Estimate: (Millions)

2006	2007	2008	2009	2010
2.5	3.0	3.5	4.0	4.0

NSF award: 5 years, 5 year extension

Intent is to have Intellectual Property Income, Research Funds, and Industrial Partners to be self-sufficient without NSF funds from 10 years forward.

Industry Membership

	Total Commitment	Undesignated
Sponsoring Member	$\geq \$35,000$	Amt over \$35,000
Regular Member	$\geq \$15,000$	Amt over \$15,000
Observer Member	$\geq \$5,000$	Not Available

Industry Membership

- Industry Members commit to participation in an annual review to advise future directions for research efforts.
- Intent is to encourage research in those areas which would be most beneficial to economic growth while maintaining and/or improving any environmental and health factors.

Observer Member Privileges

- Facilitated access to CRWC graduate students
- Assistance in using the resources of the University
- Access to all meetings, general reports, workshops, etc.
- Reduced-price access to laboratories

Full Member Privileges

- All privileges of limited membership
- Collaboration on a research project of the member's interest
- Copies of all non-proprietary project reports
- Privilege of placing a research scientist or engineer on site at CRWC



Sponsoring Member Privileges

- All privileges of full membership
- Options for intellectual property participation

Questions?

- Please contact:
- James H. (Jim) Jones,
Industrial Liaison Officer

327 EIB

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Please Visit Our Website:

<http://www.clemson.edu/CRWC>



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Fluor Daniel Engineering Innovation Bldg





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