Rapidly Deployable Radio Networks

J. Evans, K. S. Shanmugan, V. Frost, G. Minden,
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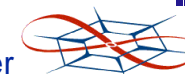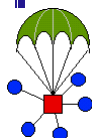Dan Depardo, Kambhammettu Nalinimohan (Mohan),
Craig Sparks, Scott Woodward

Ricardo Sanchez, Deb Chatterjee, Tim Gallagher, Saravanan
Radhakrishnan, Fadi Wahhab, Shane Haas, John Paden

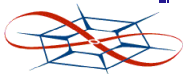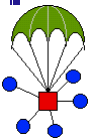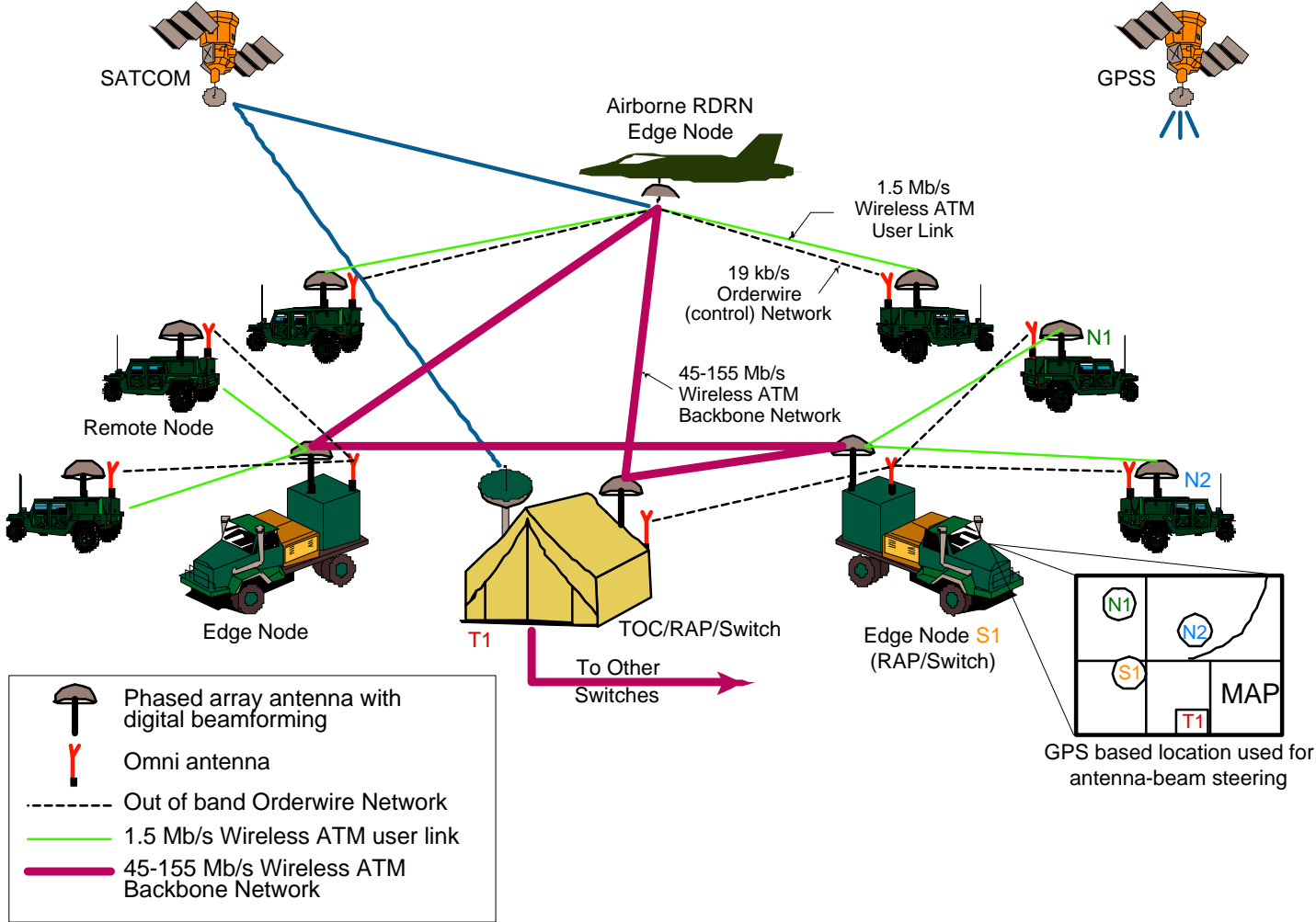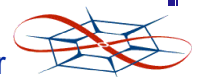*Information & Telecommunication Technology Center*
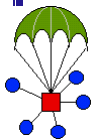*University of Kansas*
http://www.ittc.ukans.edu/RDRN

ITTC Technology Review Day
29 September 1997

RDRN Concepts

SATCOM

GPSS

Airborne RDRN
Edge Node

1.5 Mb/s
Wireless ATM
User Link

19 kb/s
Orderwire
(control) Network

Remote Node

N1

45-155 Mb/s
Wireless ATM
Backbone Network

N2

Edge Node

T1

TOC/RAP/Switch

To Other
Switches

Edge Node S1
(RAP/Switch)

	MAP
N1	N2
S1	T1

GPS based location used for
antenna-beam steering

Phased array antenna with
digital beamforming

Omni antenna

Out of band Orderwire Network

1.5 Mb/s Wireless ATM user link

45-155 Mb/s Wireless ATM
Backbone Network

RDRN Concepts

RDRN Phase I Accomplishments

- Developed digital beamforming transmitter, omnidirectional receiver at 1.2 GHz
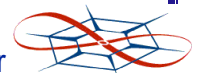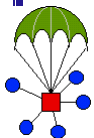   - 10^{-6} BER at ~10 km with 4 elements @ 2 W each

- Developed interoperable software ATM switch with flexible control architecture
    - based on Linux/ATM stack and Q.port
    - OC-3c and wireless ports

- Developed location-based (GPS) network control algorithms

- Developed adaptive HDLC algorithms

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# RDRN Phase II Project Goals

- Develop a modular and configurable radio with moderate range

- Develop rapidly self organizing IP/ATM based wireless network

- Deploy research prototypes for experimentation

- Extend location-based network control algorithms for QoS sensitive traffic

- Develop dynamic channel, beamforming, and link adaptation algorithms
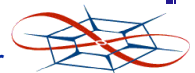
New Ideas

- Modular and scaleable architecture based on phased array antenna, digital beamforming software radio, and software ATM switch

- Extended architectures and protocols for a quickly deployable radio network with highly mobile user and switch nodes

- Protocols for highly mobile communications with quality of service constraints, based on location information
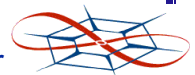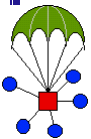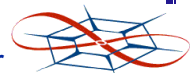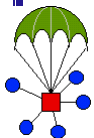
RDRN Phase II Focus Areas

- Software radio with smart antennas
  - DBF receiver architecture
  - fabrication of software radio testbed
  - digital beamforming dynamics
  - cylindrical and hemispherical antennas
- System implementation & integration
  - design modular TX and RX
  - scaleable computing resources
  - system integration, testing, evaluation
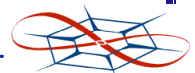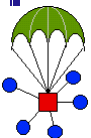
RDRN Phase II Focus Areas

- Adaptive networking
  - flowspec for mobile nodes
  - efficient MAC protocols
  - resource reservation styles
- Channel estimation & link adaptation
  - channel estimation algorithms
  - angle of arrival estimation & beamforming
  - link level adaptation

Schedule

Channel & link adaptation algorithms

Advanced antennas

System integration and testing

IP/ATM performance evaluation

Efficient MAC protocols

Scaleable computing resources

Design modular TX & RX

Design digital beamforming receiver architecture

FY97   FY98   FY99   FY00

Flowspec for mobile nodes

Project start

Resource reservation styles

Beamforming dynamics

Fabricate software radio testbed

End of Phase II