HFIA HIGH FREQUENCY INDUSTRY ASSOCIATION

January 2012 Meeting – San Diego California, USA

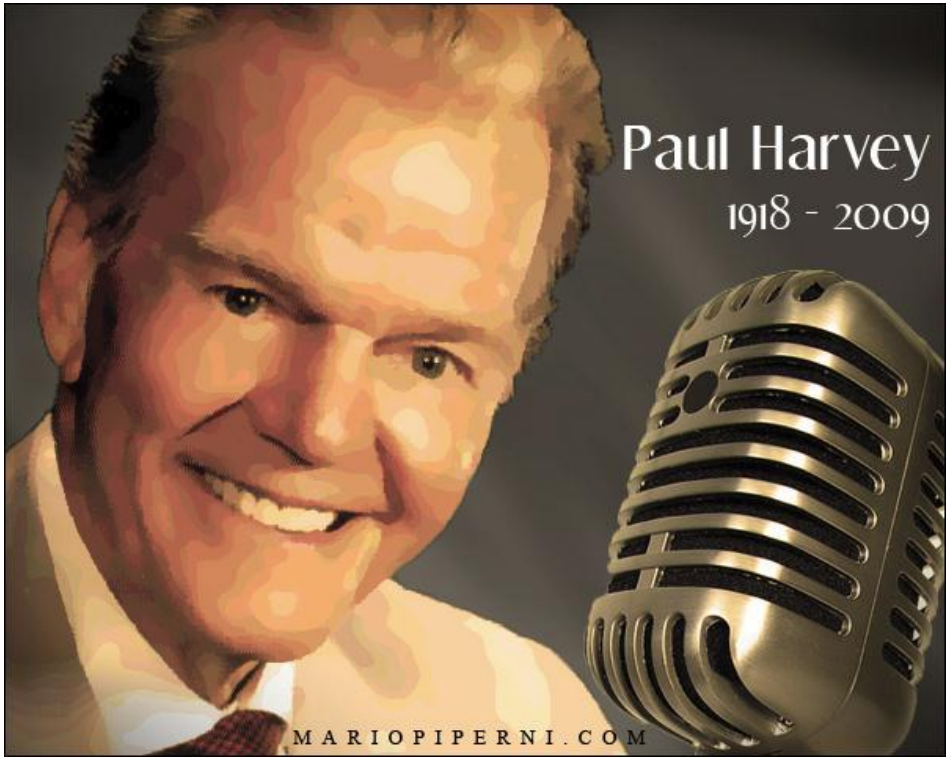
Are HF BLOS Circuits Still a viable communications medium in 2012?

Summary:
An attempt to answer the question raised by many military and government communicators on a regular basis. With so many mediums available today, is HF still viable considering the large capital investments, limited bandwidths and atmospheric challenges? Briefing will present the authors comments and relevant comments from other HF industry leaders, address the impact or potential impact of new technology on modern HF communications circuits.

Presenter:

Mark Allen, W6PC
Senior Vice President
Antenna Products Corporation
Established 1946 – Mineral Wells, Texas, USA
allen@antennaproducts.com www.antennaproducts.com

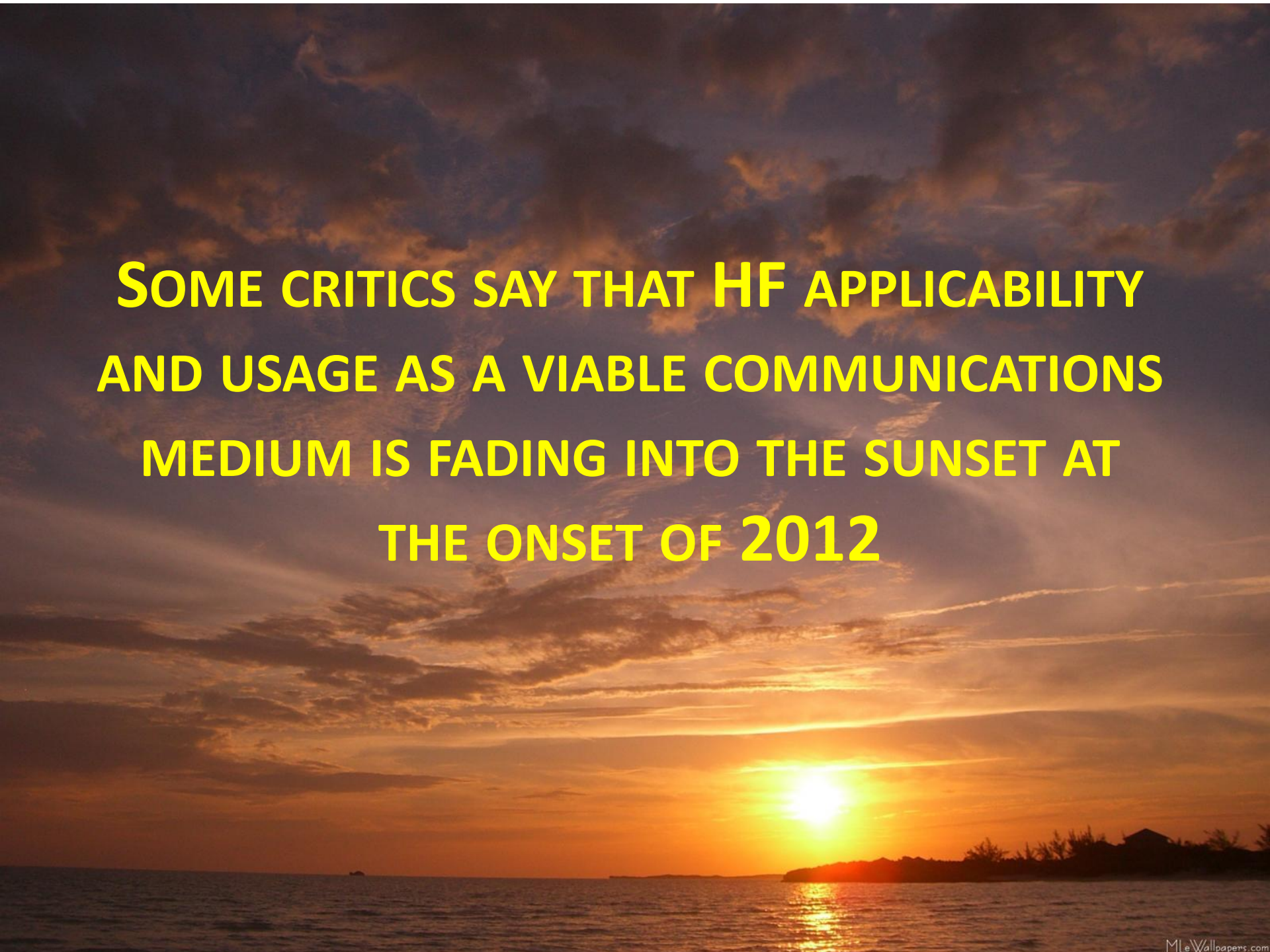
Thank you for your attention !



As Paul Harvey used to say;

“Here's the rest of the story”

Image courtesy of SUPPORT Mario Piperni dot Com

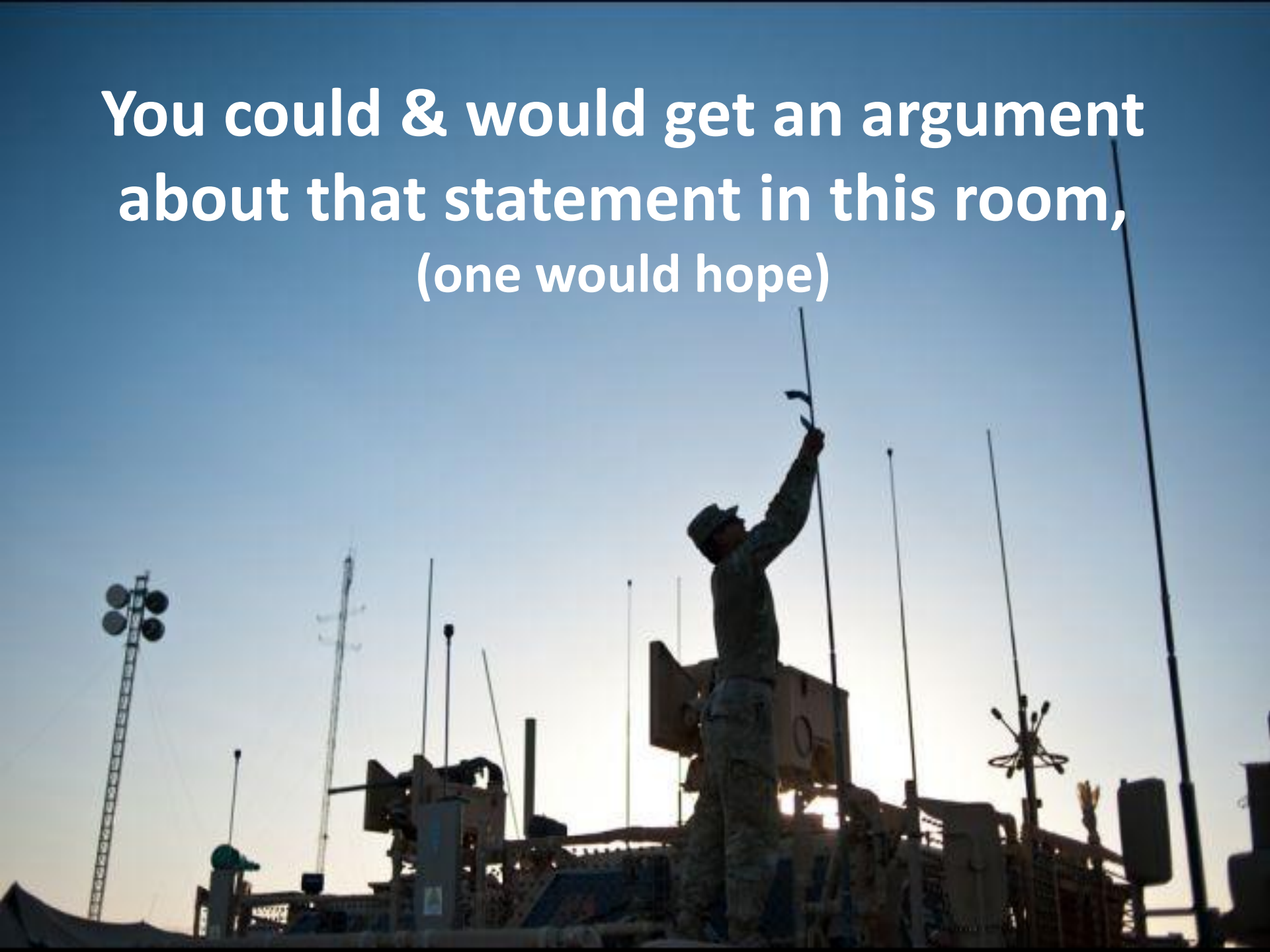

SOME CRITICS SAY THAT HF APPLICABILITY AND USAGE AS A VIABLE COMMUNICATIONS MEDIUM IS FADING INTO THE SUNSET AT THE ONSET OF 2012

Since the Mid-90's there have been many vocal proponents that HF is a dying technology whose time has come and gone.

These Have included, some:

- Military Leadership
- Congressional Leaders
- Some Members of the User Community
- Some HF Manufacturers (hard to believe)
- Leaders in the Satellite Community

Photo Courtesy US EPA


You could & would get an argument about that statement in this room,
(one would hope)

Why would someone come to such a conclusion?

1. Uninformed ?
2. Proponent of another technology ?
3. Not abreast of technological innovations in HF ?
4. Based on erroneous prior experience or beliefs
5. Drawing conclusions on misinformation
6. Making assumptions that “seem” right but are not fact based

Common User mental images when HF radio usage is mentioned

- Complicated to use
- Subject to the whims of the atmosphere
- Old, outdated technology
- Slow
- Unreliable
- Low capacity
- Expensive
- Big / Bulky

Drawing Courtesy mamamia.au

Times, they are a changing

One simple example

Big ?

Bulky ?

Old Technology ?

Complicated?

TIMES, THEY ARE A CHANGING

1. **Where are all the HF engineers?**

2. **Is anyone teaching HF radio at a college academic level?**

3. **If there is a demand, will engineers come?**

TIMES, THEY ARE A CHANGING

1. Where are all the HF engineers?

- **Retired?**
- **Dead?**
- **Retired & dead?**
- **Different occupation (their choice)**
- **Different occupation (employers choice)**

TIMES, THEY ARE A CHANGING

2. Is anyone teaching HF radio at a college academic level?

- Well, are they?
- Academic web searches show little out there
- Calls to 4 universities – HF "may" be "touched on" in various EE curriculums
- Most likely HF education out there, but hard to identify

Computer Illustration Courtesy- HowardDigital

TIMES, THEY ARE A CHANGING

3. **If there is a demand, will engineers come to HF engineering?**

    - **Or will they?**
    - **What technologies are engineers seeking today as an occupation?**
    - **Cellular, DAS, networking, data security, gaming**

The Census

How Long Have You Been In HF Radio field?

Marconi – 1874 ~ 1920
1909 Nobel Prize (with Braun) for
"development of wireless telegraphy"

(from Wikipedia)

- ✓ < 5 years
- ✓ 6 ~ 20 years
- ✓ Just a damn long time, 20+

2011 Young Engineer of the Year, Danielle Vardaro --The Boeing Company

(From IEEE)

WHO ARE THE MAJOR USER GROUPS IN 2012?

MILITARY

Tactical

Logistical

Strategic

WHO ARE THE MAJOR USER GROUPS IN 2012?

Non-Military

Government

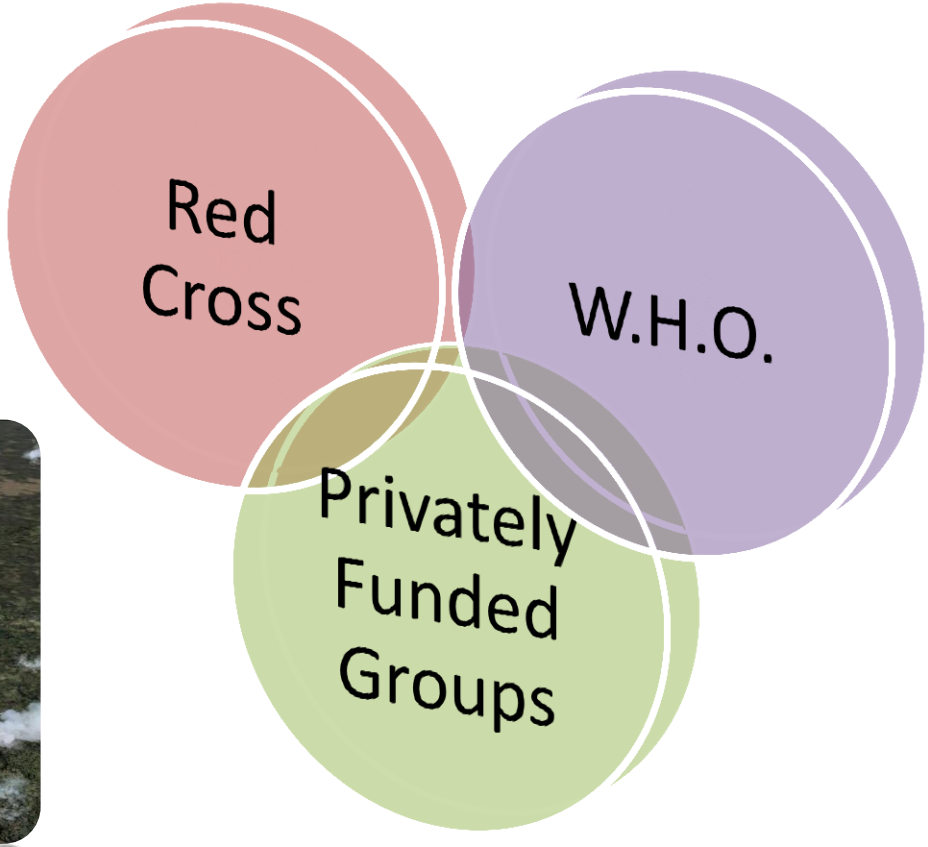
WHO ARE THE MAJOR USER GROUPS IN 2012?

Commercial

PacIOOS
Pacific Islands Ocean Observing System

WHO ARE THE MAJOR USER GROUPS IN 2012?

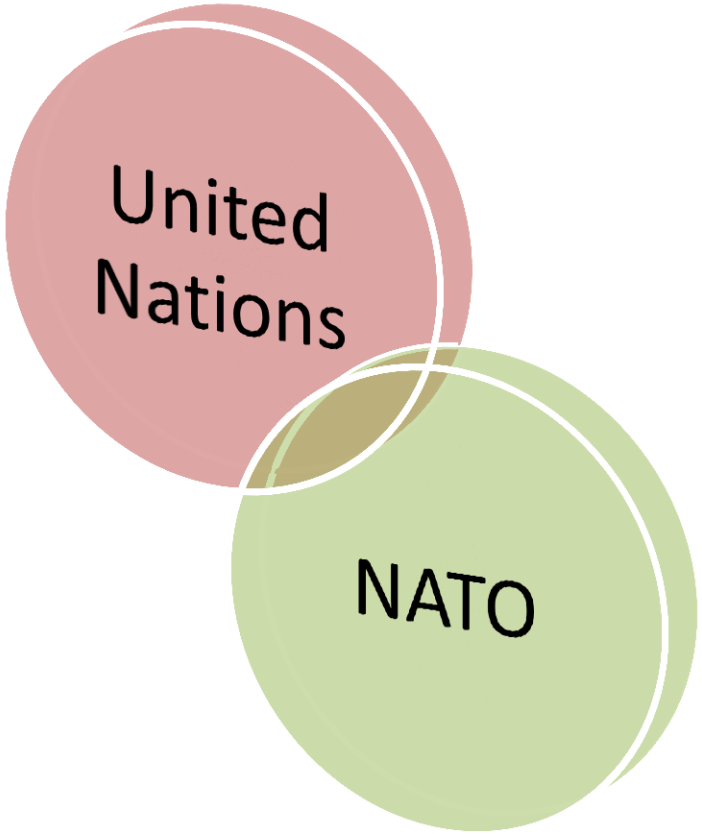
Humanitarian



World Health Organization

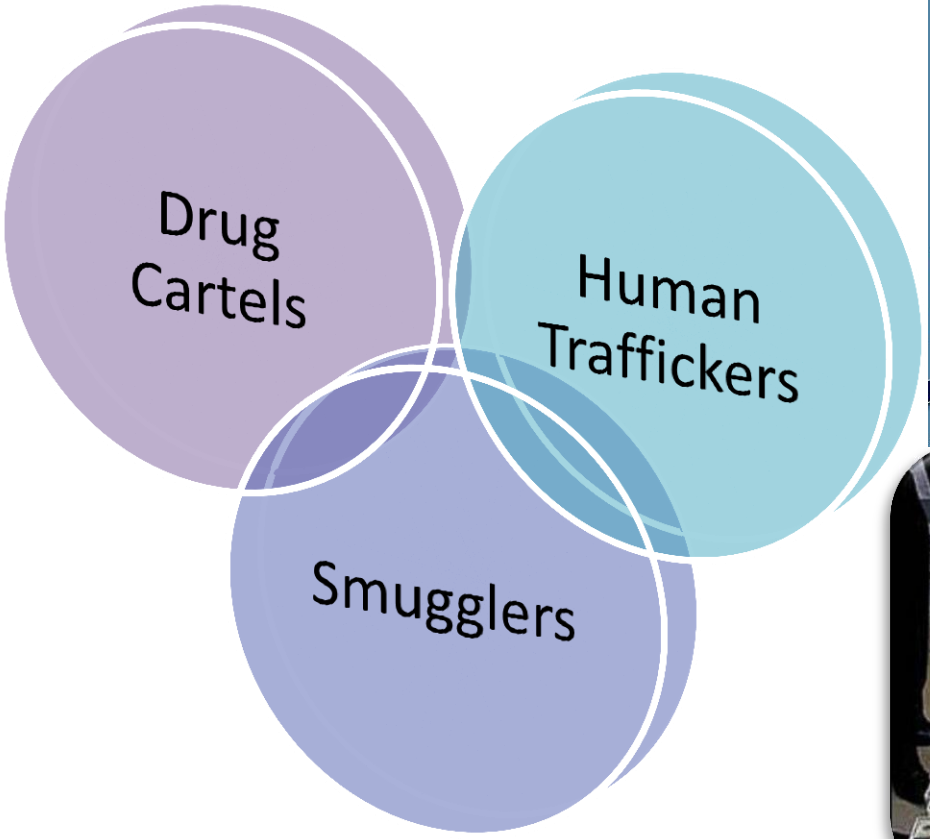
WHO ARE THE MAJOR USER GROUPS IN 2012?

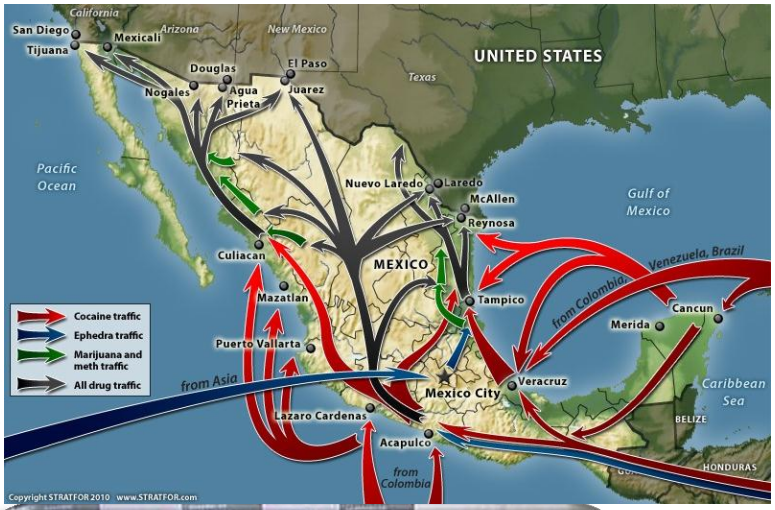
Joint Services



WHO ARE THE MAJOR USER GROUPS IN 2012?

Illicit Users





WHAT IS NCS 3-10 AND WHY SHOULD I CARE?

From NCS Public Data

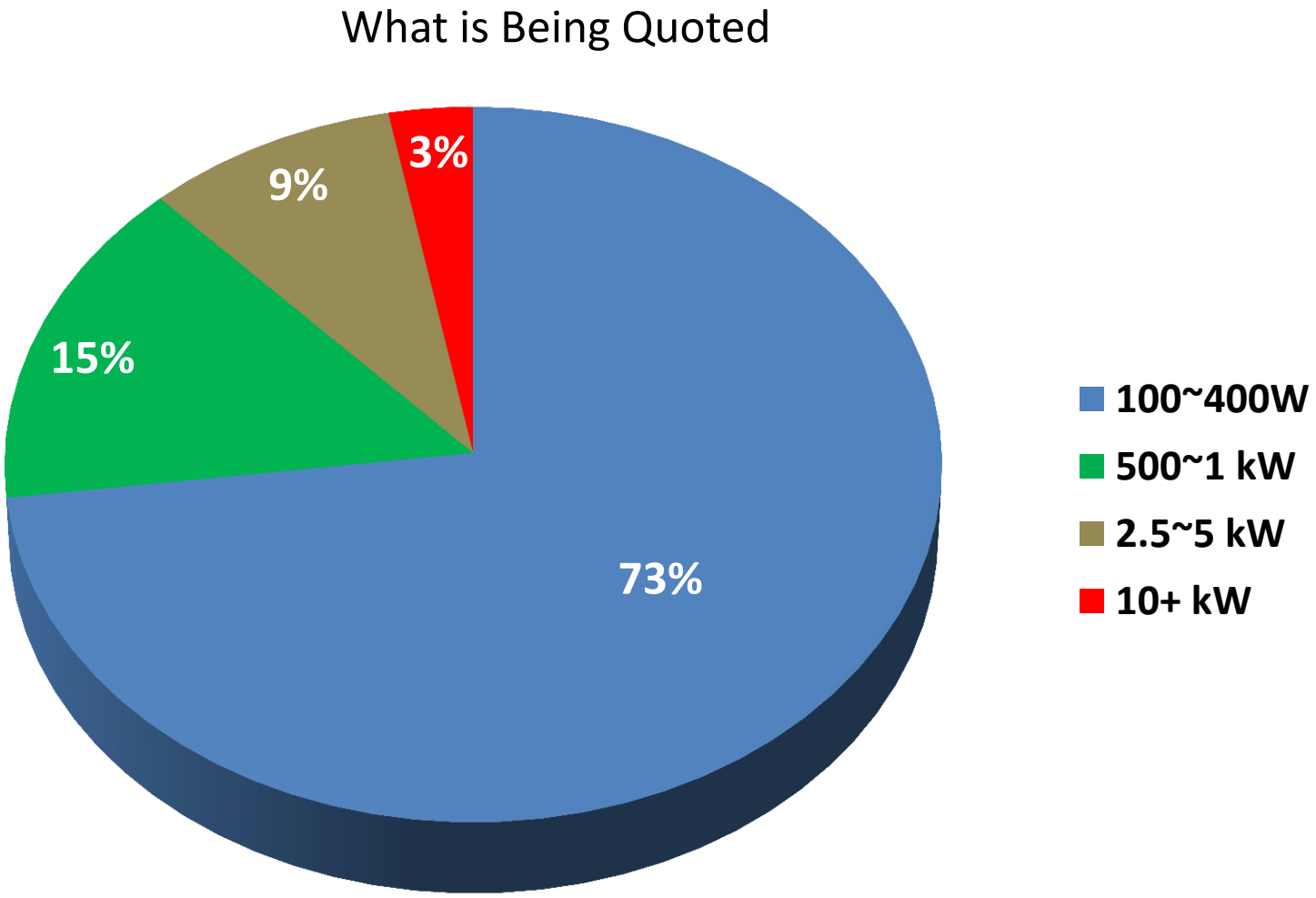
What is NCS Directive 3-10?

"The NCS developed NCS Directive 3-10 in coordination with the Office of Science & Technology Policy (OSTP), the Committee of Principals, and other department and agencies of the Federal Government. This directive describes the Minimum Requirements for Continuity Communications enabling departments and agencies to execute their mission essential functions. The NCS also developed engineering implementation guidance to assist in this effort."

What is CCA?

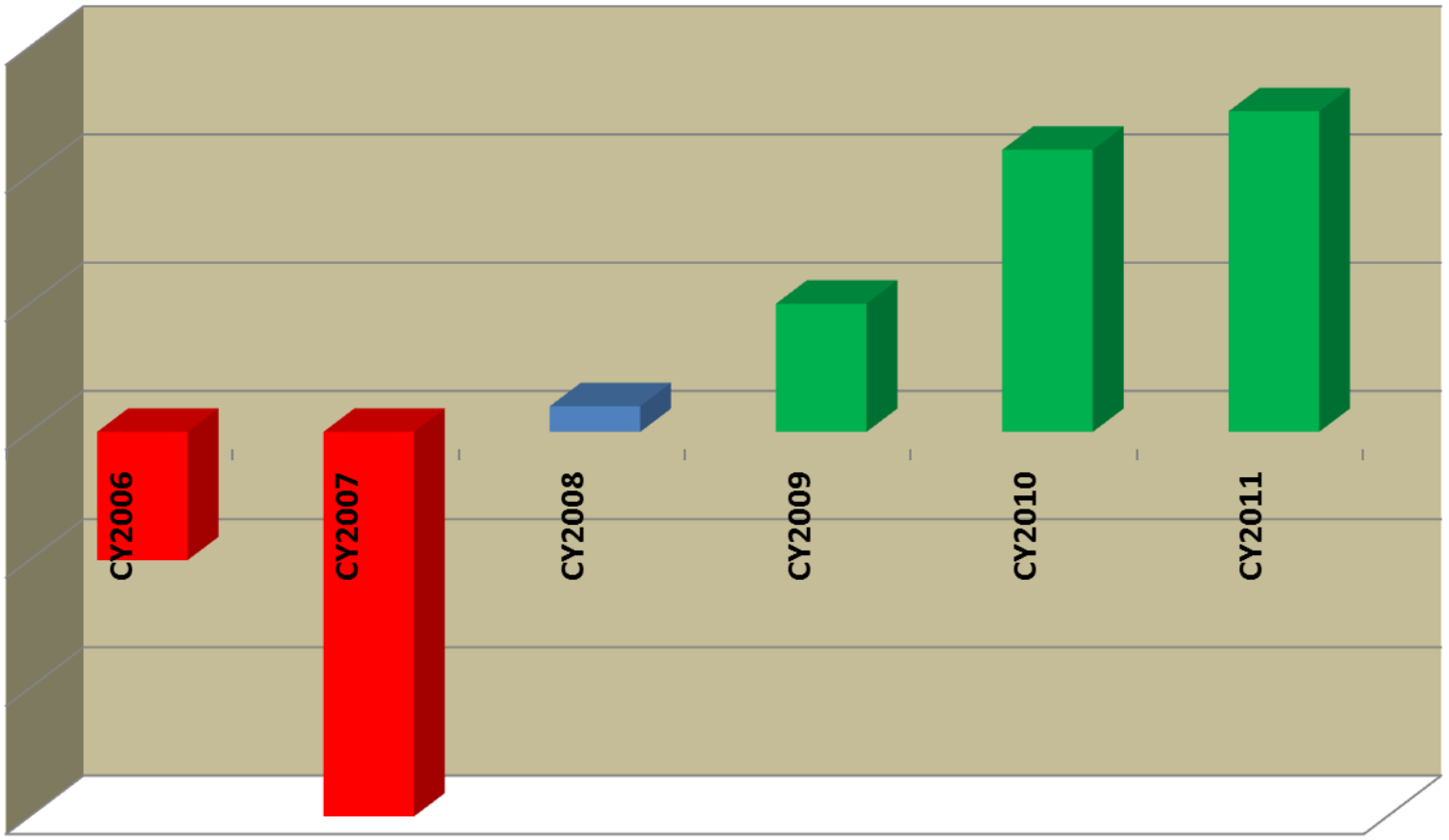
"Continuity of Communications Architecture (CCA) is an ongoing project that will represent a system of systems interconnecting the minimum communications described in NCS Directive 3-10."

Result of Informal Survey Among OEM strategic HF manufacturers (Regarding CY 2010 ~ 2011)



Result of Informal Survey Among OEM strategic HF manufacturers
(Regarding CY 2010 ~ 2011)

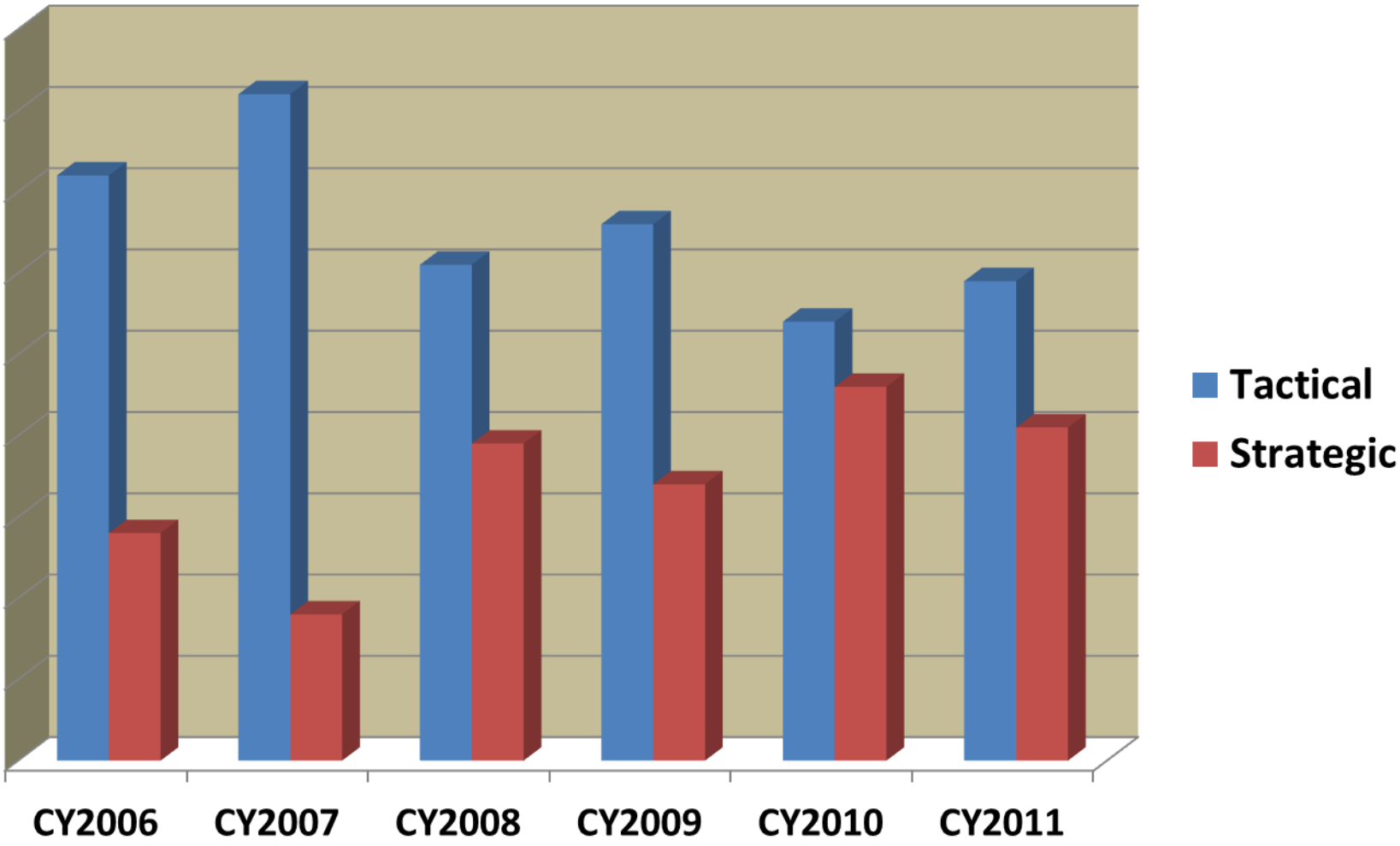
Number of Quotations Made (over 10 year running average)



Result of Informal Survey Among OEM HF Manufacturers

(Regarding CY 2010 ~ 2011)

Type of Equipment Quotations Made



SOME PEOPLE COULD, WOULD AND DO ARGUE THE WE HAVEN'T COME VERY FAR IN HF RADIO IN THE RECENT PAST.

From Internet - Ham Radio Station by W2GEC

Competition for HF Budgets $$$

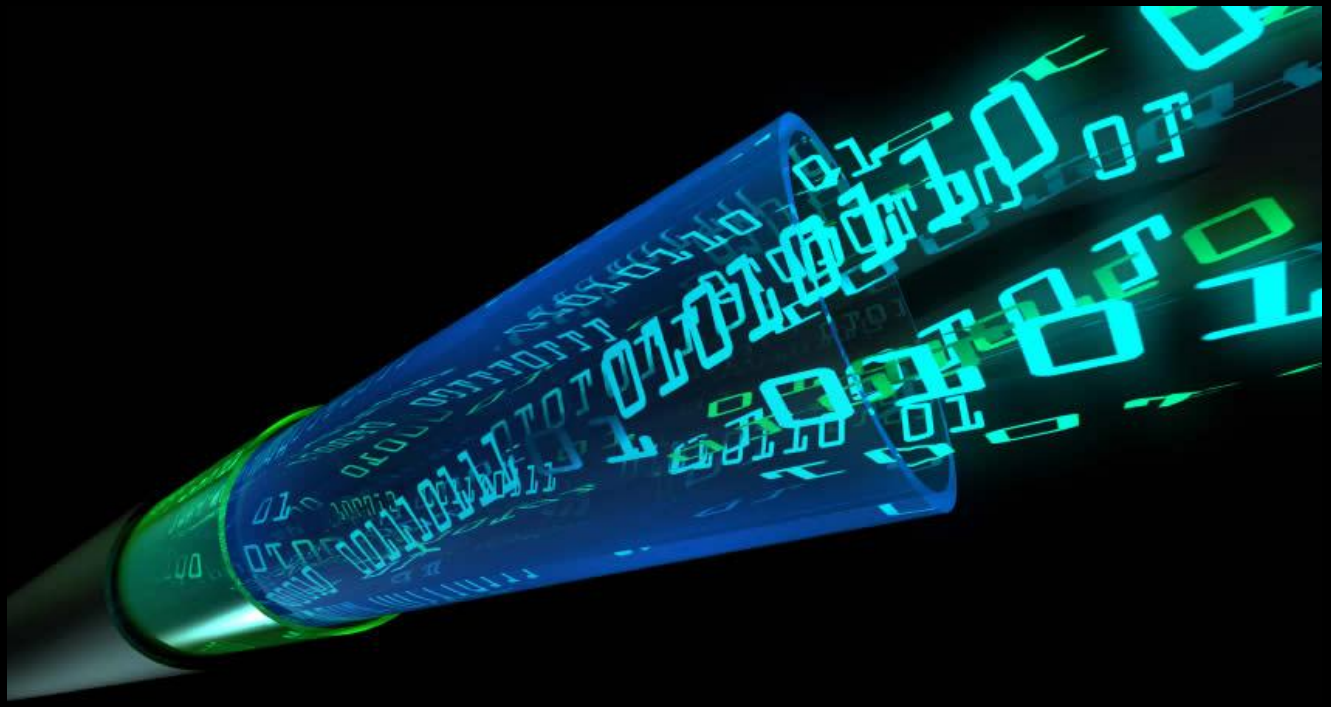
- LOS media
  - Satellite
  - Laser
  - Microwave / Millimeter wave
- Near LOS
  - Mesh networks
  - VHF & UHF terrestrial radio
  - The electronic warrior
- Integrated media
  - Wireline
  - Internet (public, sipper, nipper)
  - VoIP

How Big Is Your Pipe?

It's a given in 2012, everyone needs a bigger pipe to move data with greater capacity and speed, no matter what the medium from HF radio to fiber. At one point 300 baud was considered fast.

The original model 300 baud Smartmodem
Courtesy Wikipedia

Success or Failure as a Transmission Medium



The continued viability, continued and future implementation of HF radio as a transmission medium rests in the mediums ability to transport more data faster and more reliably.

Image - HDCP

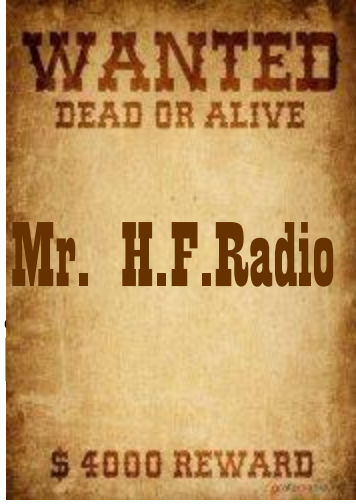
What Our Customers Want / Need

1. A reasonable assurance that their capital investment will result in their message will arriving at the desired point.
2. A reasonable assurance their message will arrive, in a timely fashion.
3. A reasonable assurance their message will arrive, accurately.

FedEx Express

When It Absolutely Positively Has To Be There

What Our Customers Want / Need



1. More accurate forecasting tools to propagation modeling
2. Technology to move more data
3. Regulatory changes to support technology
4. IP based connectivity for HF equipment
5. OEM's to realize there are fewer & less skilled HF operators-eliminate the operator
6. Self defining networks that "auto-configure" using sevices like ALE

SATELLITE NETWORKS ARE WONDERFUL UNTIL…….

The Washington Post

China Criticized for Anti-Satellite Missile Test

Destruction of an Aging Satellite Illustrates Vulnerability of U.S. Space Assets

By Marc Kaufman and Dafna Linzer
Washington Post Staff Writers
Friday, January 19, 2007

The Chinese military used a ground-based missile to hit and destroy one of its aging satellites orbiting more than 500 miles in space last week - a high-stakes test demonstrating China's ability to target regions of space that are home to U.S. spy satellites and space-based missile defense systems.

The test of anti-satellite technology is believed to be the first of its kind in two decades by any nation and raised concerns about the vulnerability of U.S. satellites and a possible arms race in space.

China's action drew sharp protests from other nations with satellite programs -- a predictable response that experts said dramatically illustrates Chinese willingness to face broad international criticism when it comes to space, which Beijing considers a key part of the push to modernize its military and increase its ability to compete in high-tech warfare.

"The U.S. believes China's development and testing of such weapons is inconsistent with the spirit of cooperation that both countries aspire to in the civil space area," National Security Council spokesman Gordon Johndroe said yesterday. "We and other countries have expressed our concern regarding this action to the Chinese."

A spokesman at the Chinese Embassy said that he had no information about the anti-satellite test. The Chinese military did not mention the test either. But a Chinese newspaper that concentrates on foreign affairs, Global Times, relayed the reports from Washington in today's editions. The newspaper quoted Maj. Gen. Peng Guangquin as saying that the U.S. government was making too much of the test.

In addition to introducing a renewed military dimension to space, the destruction of the Chinese satellite created a large "debris cloud" that can seriously damage other satellites in nearby orbit, and possibly even spacecraft on their way to the moon or beyond. Analysts said that based on computer models, as many as 300,000 pieces of debris may have been created. While many would be very small, they said, hundreds would be large enough to create potentially serious problems.

...s and the Soviet Union tested anti-satellite technology in the 1980s, and the United States shot down one of its orbiting ...ially as a result of the debris problem, both sides stopped the programs.

12.02.2009 Reuters

Author Andrea Shalal-Esa

About ISON

…The crash of a U.S. communications satellite and a defunct Russian military satellite was a wake-up call that government action was needed to "clean" up increasingly congested orbits, said Vladimir Agapov, a senior Russian scientist.

It also "clearly demonstrated the inability of the current surveillance systems" to accurately predict close encounters quickly enough to avert a collision, said Agapov. He works with the International Space Observation Network (ISON), a nongovernmental group that uses a worldwide network of 18 scientific optical facilities to track objects in space…

Full material

Space traffic congestion needs money, technology. Thu Feb 12, 2009 2:19pm EST

By Andrea Shalal-Esa – Analysis

WASHINGTON (Reuters) – The dramatic collision of U.S. and Russian satellites is the latest in a series of orbital events that highlight an urgent need for better monitoring of the growing traffic in space.

Tuesday's crash will increase calls for additional Pentagon spending to track space debris and satellites, U.S. space experts said. It also may give new impetus to a drive to set international standards for companies and governments operating in space that may include equipping new satellites with sensors or mandatory propulsion systems so they can be moved to ease traffic congestion.

China's anti-satellite test in January 2007 sparked concerns about the U.S. ability to quickly determine if any problems were caused by natural phenomenon, technical malfunctions, debris strikes, or even enemy attacks.

Iran's launch of its first satellite earlier this month was a reminder of the growing number of space-faring nations which are adding to the traffic.

U.S. and European officials this week called for expanded efforts to monitor objects in space. Better information and technology might have helped to avert the satellite crash, which created at least 500 to 600 new bits of debris that could jeopardize other spacecraft in the future, they said.

"It emphasizes the need for expanded safety and navigational situational awareness, as well as the potential benefit of establishing some kind of international standards," said one senior U.S. official, who asked not to be named.

U.S. defense spending is under increasing pressure, but lawmakers are more apt to back preventative spending now that a major collision — once considered unlikely — has occurred, said one congressional aide.
MORE

Informal (off-the-record) survey of key Naval communications players regarding HF usage

	Use MIL Satellite	Use Comm Satellite	Use HF	Vessel OOT	Use of Satellite in Next 5 Years	Use of HF in Next 5 Years	HF CapX Anticipated	Main Reason For HF Use
N America	X	X	X	N	INCREASE	STEADY	YES	R&R MARKET, SAT IMPAIRMENT, CONTINUITY
Central America		X	X	Y	DOWN	UP	YES	COST CONTROL, BUDGETS
S America		X	X	Y	DOWN	UP	YES	REDUCTION OF AIRTIME BUDGETS
N Europe	X	X	X	N	STEADY	UP	YES	REDUNDCY / DIVERSITY / SAT CONGESTION
N Africa	X	X	X	N	STEADY	STEADY	YES	REDUNDCY
S Africa		X	X	Y	DOWN	UP	YES	REDUCTION OF OPERATING COSTS
Pac-Rim	X	X	X	N	STEADY	UP	YES	TIGHT BUDGETS, INCREASED AIRTIME COSTS

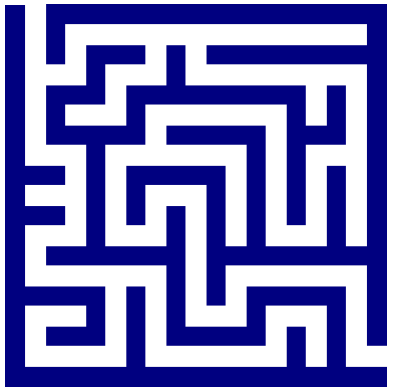
Summary of key comments heard:

- Satellite congestion
- Satellite inoperability (failure, shoot-down, jamming)
- HF reliability is improving
- Promising new technology for HF systems

PROMISING TECHNOLOGY

- **Software defined HF radio is now coming of age (it's here folks)**
- **Improved / new modem technology, improved symbol rates (Sym/sec)**
- **Advances in DSP / filters /processing technology to allow digital long haul circuits**
- **24 kHz Wideband HF Data Modem Standards**
- **VoIP capabilities are nearly the "norm" in current generation radio and modem devices**
- **New processing capability, including multiple parallel processors in radios are bringing high horsepower data capability inside the radio**

The Regulatory Maze of Changes



RADIO-CANADA

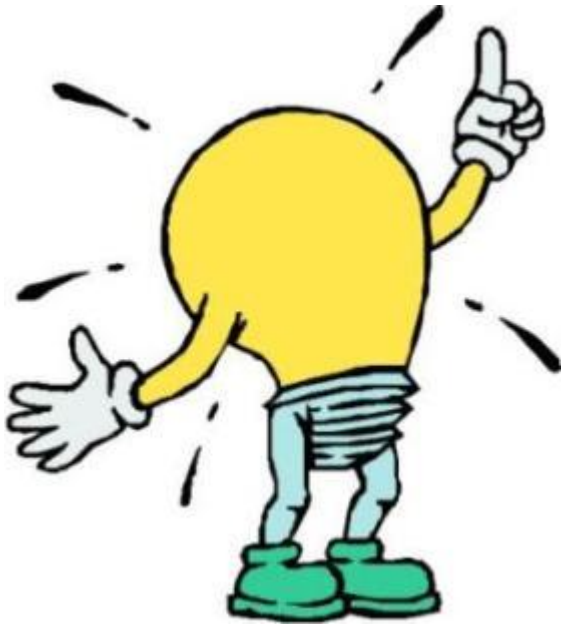
Ofcom

Australian Government

acma

The promising 24 kHz Wideband HF Data Modem Standards with bandwidths from 3~24 kHz will have to be approved and endorsed by relevant regulatory agencies on a global basis.

WHAT ARE THE HARD LIMITS?



- **Harry Nyquist -** $f_p \leq 2B$
- **Ralph Hartley-** $M = 1 + \frac{A}{\Delta V}.$
- **Shannon–Hartley theorem-** $C = B \log_2 \left(1 + \frac{S}{N}\right)$

The Amateur Radio Factor?

- It is estimated that more than 50% of persons involved in HF professionally are also amateur radio operators.
- Are hams a pain in the butt, useful contributors, or a distraction to HF Pro's

  - What came first? Ham radio or the job?

    - Art Collins – Founder Collins Radio Company - W0CXX
    - E. F. Johnson – Founder E.F. Johnson Company - 9ALD (W9ALD)
    - Dr. Michael Schulhof – (fmr) CEO Sony USA – K1OKI
    - Dr. Harold Beverage – Inventor(antennas) & RCA – W2BML
    - John Scully – CEO Apple Computer – K2HEP
    - Robert Miller – Chief Engineer – RCA – W2IBO
    - Dr. Ulrich L. Rohde – Rohde & Schwarz – KA2WEU
    - Albert Kahn – Founder Electrovoice – K4FW
    - Ralph Haller – FCC PRB Chief – N4RH
    - Dr. Ronald Stordahl – Founder Digi-Key – N5IN
    - Michael Staal – Founder KLM Antenna (now M2) – K6MYC
    - Bary Bertiger – VP/GM of Motorola (inventor of Iridium) – WA7UKR
    - David Packard – HP – 9DRV
    - Jack S. Kilby – Nobel Prize in 2000 – Inventor of the IC – W9TGY
    - Edward J. Andrew – Founder Andrew Antenna – KB9KV
    - Karl Hassel – Founder Chicago Radio Labs (aka Zenith Radio) – 9ZN

THE AMATEUR RADIO FACTOR?

- Are there any professional HF radio developments connected to amateur radio or amateur operators?
  - Sure,
  - Developments -
    - Because of;
    - In spite of;
    - Driven by them;

Station of NE7X

What keeps HF viable as a medium in 2012?

- True global coverage with reasonable infrastructure
- Wide variety of manufacturers, features and cost
- Generally not subject to manufacturer "proprietary" protocols
- MIL-STD interface drivers amongst vendors
- End to end networks in your control
- No recurring airtime or spectrum fees
- Reliable, redundant, maintainable earthbound assets
- Proven technology & science
- Systems / networks scalable to budgets

HF LIMITATIONS AS A MEDIUM IN 2012?

- THROUGHPUT EITHER AS A VOICE OR DATA NETWORK
  - BANDWIDTH
  - SPEED

- CIRCUIT RELIABILITY
- REGULATORY CHALLENGES

- PUBLIC RELATIONS IMAGE…..

OLD – SLOW - UNRELIABLE

Topic Review of This Session:

- We have a viable communications medium
- The bars for reliability and throughput are rising rapidly
- Trying to satisfy the data needs of the "IPOD Generation" will always be a challenge.
- HF will not likely be a sufficient IP pipe in our generation
- SDR radio is becoming the "norm", good news !

Action Points From This Meeting:

- Be a knowledgeable HF use proponent
- Actively correct misinformation
- Disseminate positive news about HF and HF technology
- Stay informed (as you are by being here)
- Encourage new and continuing R&D efforts within your organizations
- Support favorable regulatory movement

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On behalf of APC, and my colleagues who's jobs depend on HF radio, thank you for the opportunity to address this esteemed group of HF experts