



THE APPLICATION OF ADAPTIVE HF DIGITAL COMMUNICATION TECHNOLOGY FOR FUTURE DISASTER RELIEF OPERATIONS

Presenter : Assoc. Prof. Dr. Ahmad Zuri bin Sha'ameri

*Contributors : Haji Mohd Aris bin Bernawi
Mr Zolkhonain bin Norizan
Mr Mohd Nasim bin Ismail
Mr Zahari bin Ismail*

**Effective use of Telecommunications/ICT in
Response to Disasters: Saving Lives**

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Presentation Outline



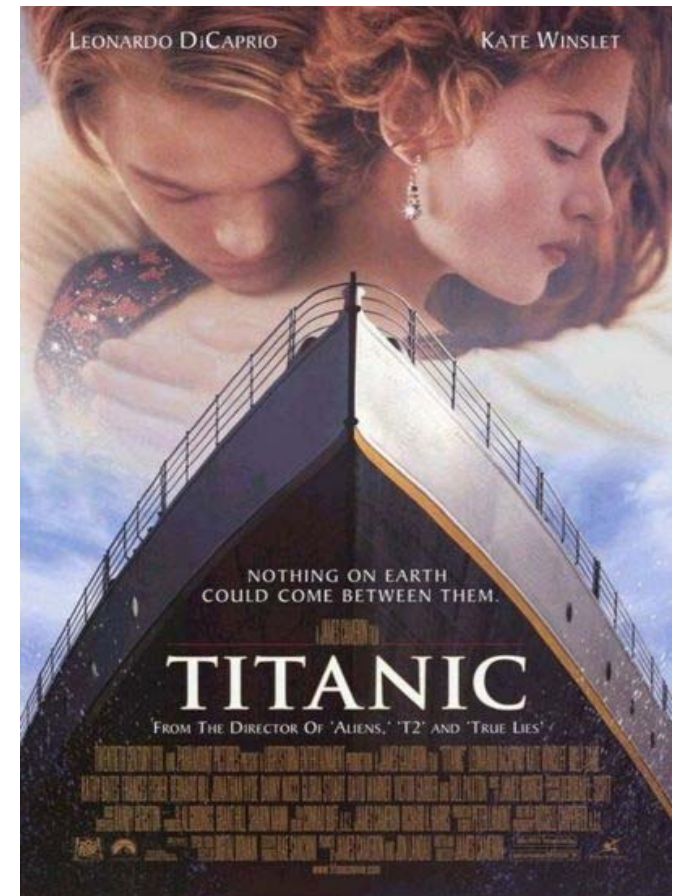
- Introduction.
- Malaysian experience.
- Common PPDR frequencies.
- SKMM Research Collaboration with UTM.
- Adaptive HF radio & data communications.
- Conclusions and future directions.

PRIMER



Who is the real hero in the sinking of the Titanic 1911?

- a) Leonardo Di Caprio
- b) Kate Winslet
- c) The Captain
- d) The Owner
- e) The radio operator
- f) None of the above



Background



- Long distance communication is possible on the HF spectrum (3 to 30 MHz) by the refraction of radiowaves in the ionosphere.
- Variability in the characteristics of the electron density layers within the ionosphere results in multipath fading phenomena that minimize the reliability of transmission.
- Eventhough replaced by satellite and optical networks, the HF spectrum is still of importance to the military, amateur radio, shipping and diplomatic services.
- The main advantages lie in the low cost in terms of infrastructure requirements and equipment setup, and being completely under national control.

Trends in HF Communications



- Communication applications are no longer limited to voice and telegraphy, but includes text messaging [Jodalen Eggen et al,2004] , email (www.sailmail.com, Thales Systems Canada Inc, Lund et-al,2007), over-the-horizon radar (Jindalee Project), facsimile and telemetry.
- Besides the introduction of new generation digital radio and multimode modems, further improvement in the reliability and data transmission throughput is achieved using adaptive radio technology, error control and m-ary modulation.
- Further applications and upgrading activities includes trials for the US Dept of Defence world wide HF network SIPRNET and NIPRNET, upgrading of the Australian Defense Force HF radio network, the US Navy Battle Force Email 66 and NATO CE2001-5066 HF Network Trials.

Beneficiaries



Any organization that requires mobility with minimum infrastructure available and operates over large expanse of water or land.

Organization includes

- Military
- Shipping operators
- Oil and gas
- Deep sea fishing
- Law enforcement
- Search and rescue
- Telemetry
- Amateur radio

Experience in Aceh



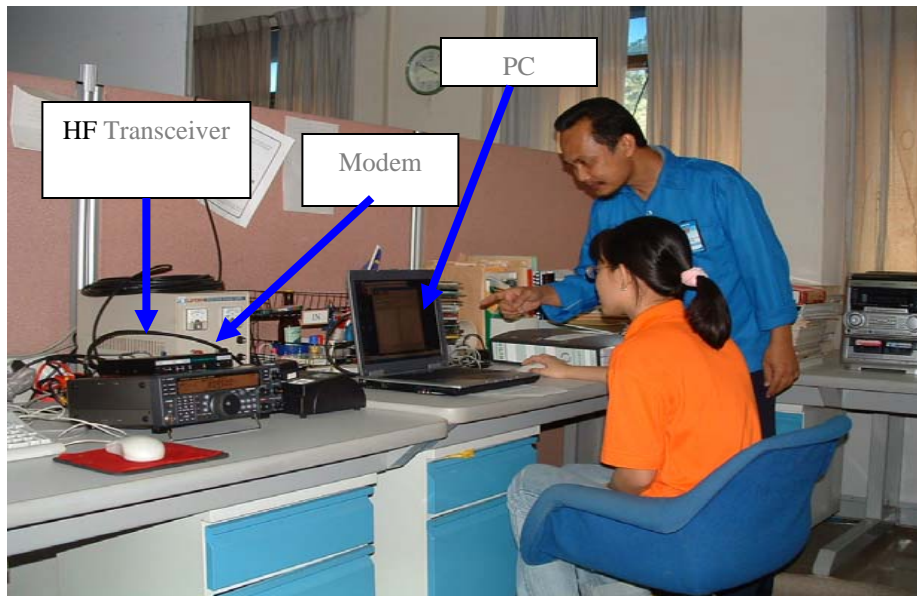
Experience in Aceh



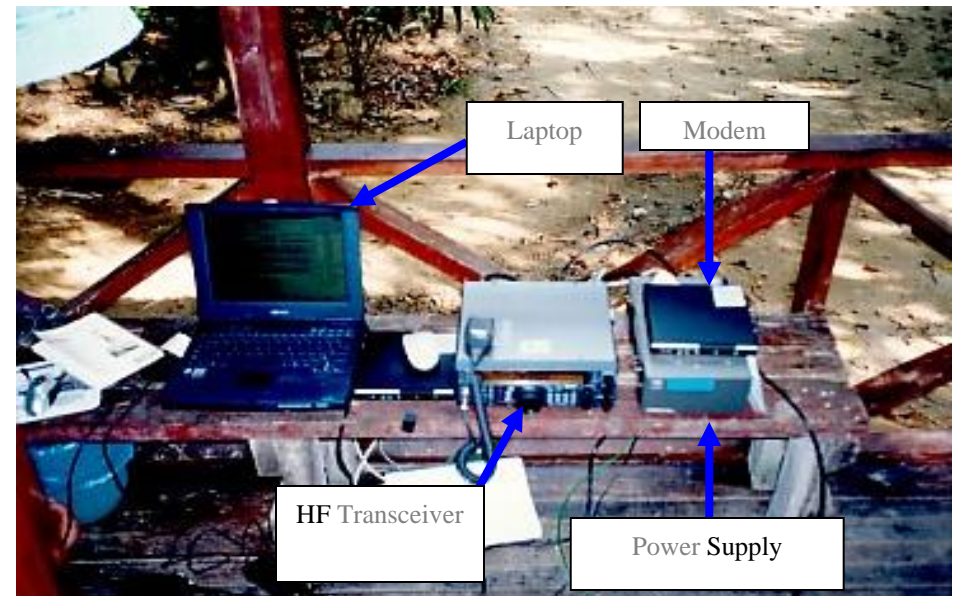
Experience in Jogjakarta



Facilities at UTM

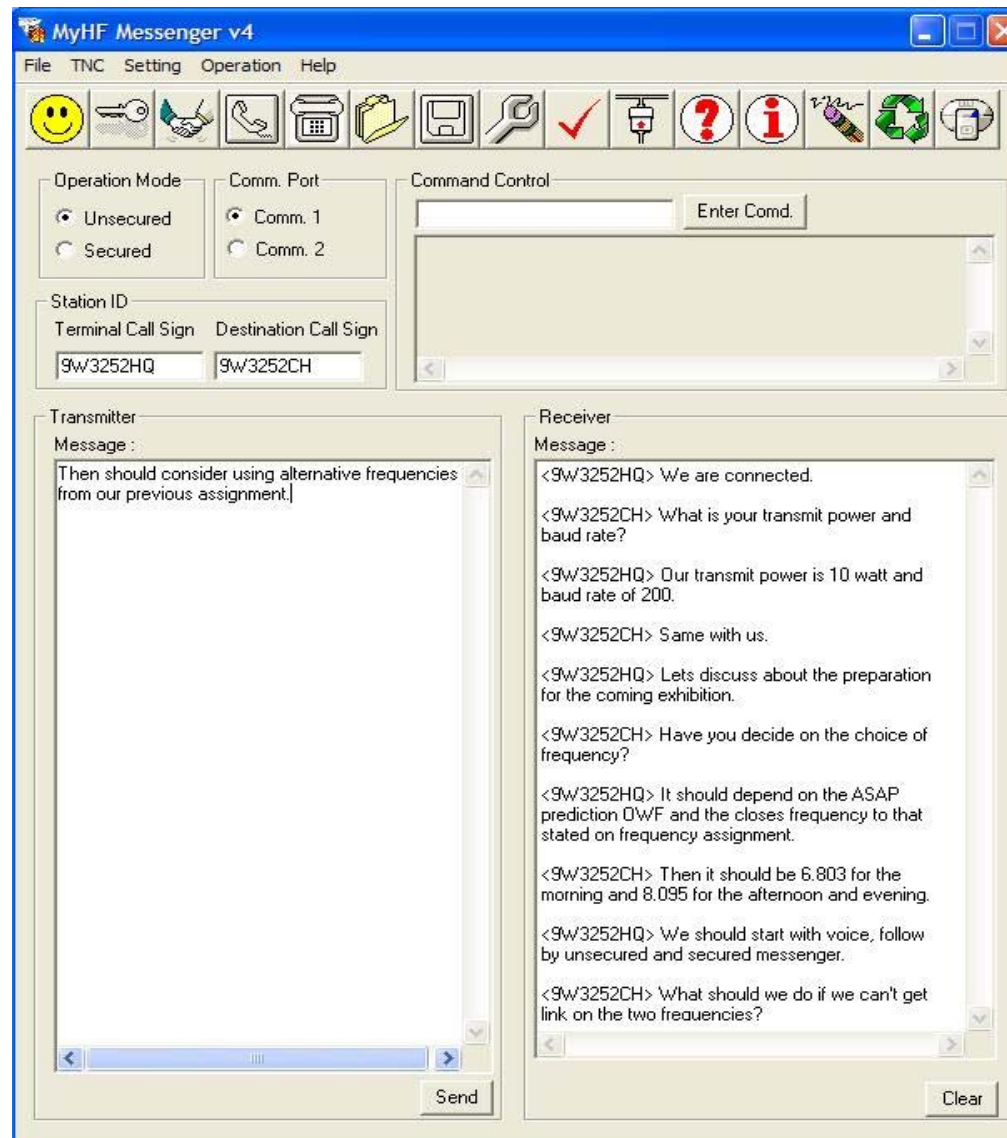


The system setup used at the DSP Lab, Faculty of Electrical Engineering, UTM



The experimental setup used at the Taman Negara Endau-Rompin

Controller Software



Opportunities for Improvement



- Choice of communication frequencies : relates to reliability with minimum transmit power.
- Application of prediction software to improve frequency management.
- To meet Res. 646 (WRC-03). common set of frequencies needed to improve coordination within the ASEAN region.
- Encourage the use of adaptive radio technologies or ALE (Automatic Link Establishment).
- Promote the use of digital communication for short messaging and email with electronic security features.

Common Frequency FACSMAB Members Countries



At 781st FACSMAB Meeting (Dec 2006) - a set of common HF frequencies were adopted as common frequencies for disaster relief communications during relief efforts within FACSMAB member countries

Table 1 - HF Frequencies for Disaster Relief Communications Within and Outside of FACSMAB Member Countries			
3 MHz Band	6 MHz Band	11 MHz Band	14 MHz Band
3.122	6.314	11.202	14.270
3.341	6.3417	11.217	14.275
3.815	6.4501	11.230	14.293
3.925*	6.771*		14.303*
3.950*			14.325*

RAC Field Services HF Emcomm Frequencies



In Nov 9 2008, frequencies and modes of operation have been pre-determined for use of the Amateur Radio Emergency Service (ARES) during an emergency or disaster occurring anywhere in Canada.

SSB Freq	Tactical	CW Freq	Tactical	Digital Freq	Tactical
75 M - 3.675 MHz LSB	Alpha	80 M - 3.535 MHz	Golf	80 M - 3.596 MHz	Mike
40 M - 7.135 MHz LSB	Bravo	40 M - 7.035 MHz	Hotel	40 M - 7.096 MHz	November
20 M - 14.135 MHz USB	Charlie	20 M - 14.035 MHz	India	20 M - 14.096 MHz	Oscar
17 M - 18.135 MHz USB	Delta	17 M - 18.075 MHz	Juliet	17 M - 18.096 MHz	Papa
15 M - 21.235 MHz USB	Echo	15 M - 21.035 MHz	Kilo	15 M - 21.096 MHz	Quebec
10 M - 28.235 MHz USB	Foxtrot	10 M - 28.035 MHz	Lima	10 M - 28.096 MHz	Romeo

Research Collaboration with UTM



- To facilitate the research on use of HF communication in PPDR applications, SKMM has awarded a research grant to the Universiti Teknologi Malaysia in September 2007.
- Research title : The Use of Frequency Adaptive HF System.
- Among the objectives are to verify HF coverage within Malaysia and evaluate performance of adaptive HF communication for voice and data.
- Collaborative organization includes : UMP, UiTM, Malaysian Red Crescent Society, amateur radio operator, RF Comm Sdn Bhd and SKMM.

Research Collaboration with UTM



- Prior to the SKMM grant award, UTM has actively conduct research on digital communications over HF through grants awarded by MOSTI.
- To ensure the research is legal, SKMM has assigned 4 frequencies to UTM for experimental purposes since 2004.
- Further frequency allocations will be assigned as requested.

Discussions



The field trials were conducted by lower power of less than 25 watts for all sites.

Based on the experimental results, PACTOR II is more robust compared to PACTOR I with transmission reduction by 3 times.

With channel coding, no errors were present during short messaging, image transmission and text file transfer for both digital modes.

For secured mode, authentication and key distribution time introduce overhead in terms of processing time. Secured data transmission time is about 1.25 times longer compared to unsecured data.

Present Status and Directions



- ✚ Sea trials conducted along the Straits of Malacca from the 17 to 20 July 2006 on the MV Pemancar.
- ✚ Permanent stations have been established in Kuala Lumpur November 2007 and Kuantan in April 2008.
- ✚ The research group is looking for an institution partner in the northern region.
- ✚ Expected delivery of Barrett adaptive radio in December 2008.
- ✚ Plan field trials for Sarawak and Sabah in 2009.
- ✚ The research group is looking for opportunity to use adaptive radio technology with both voice and data in disaster recovery operations.



THANK YOU