

NAUTRONIX

MARINE TECHNOLOGY SOLUTIONS



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OFFSHORE

*Global Leaders in Through Water Communication and Positioning Technology
for the Offshore Industry*



**Dr Andrew Jaffrey
Engineering Manager
Nautronix plc
25th January 2007**

**“High reliability acoustics
applied to the wireless
control and monitoring of
subsea equipment”
FFU 2007 – Stavanger**

The banner features a dark blue background with three overlapping, semi-transparent globes showing different parts of the Earth. The word "NAUTRONIX" is written in a stylized, white, hand-drawn font in the top right corner. Below it, the website "www.nautronix.com" is written in a smaller, white, sans-serif font. On the left side, the word "NAUTRONIX" is written in a bold, white, sans-serif font, followed by "MARINE TECHNOLOGY SOLUTIONS" in a smaller, white, sans-serif font. The word "Contents" is written in a large, bold, white, sans-serif font below the company name.

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Contents

- **Introduction**
- **Background**
- **Technologies**
- **Examples**
- **The future**
- **Summary**
- **Animation**

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Nautronix's past includes experience in the Defence, Shipbuilding – Marine, and Ocean Science markets.

These areas of the business were sold in 2006 to a large international defence company to allow Nautronix to focus solely on applying its core ADS² technology to the Global Offshore industry.



History – The Dark Ages

- Like any new venture, the early days of subsea acoustics were not very sophisticated
- There were many limitations, not least the signal processing capability available to system designers (analogue)
- The signalling could be likened to Fred Flintstone and Barney Rubble banging rocks together underwater to send messages to each other



History – evolution

- **Transducer design capabilities improved**
 - Able to specify directional or omni-directional hydrophones as required
 - Material selection and manufacturing processes
- **Signalling advanced**
- **Computing power increased**
 - Moved into Digital Signal Processing (DSP)
 - Consumer electronics led to the ready availability of cheap electronic components
- **Applications became more accurate**
- **But, subsea acoustics could still suffer from a bad press**

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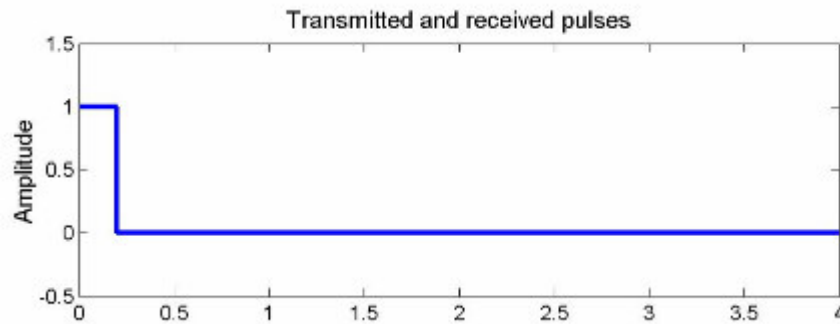
History – revolution

- Introduction of new signalling techniques
- Greatly increased processing power available
- Applications became much more demanding
 - Security
 - Reliability
 - Range

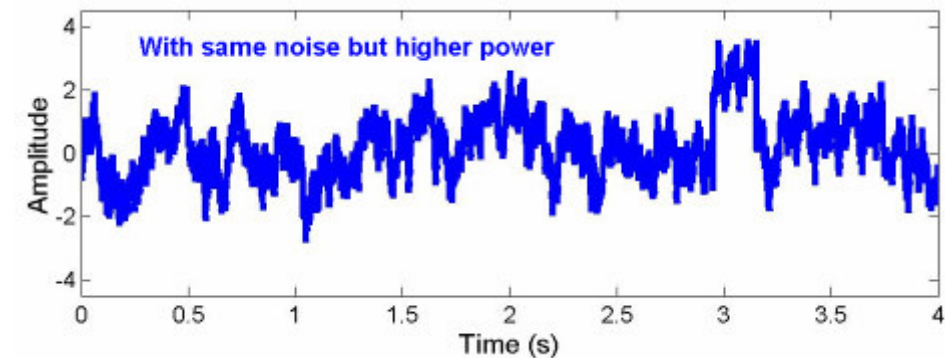
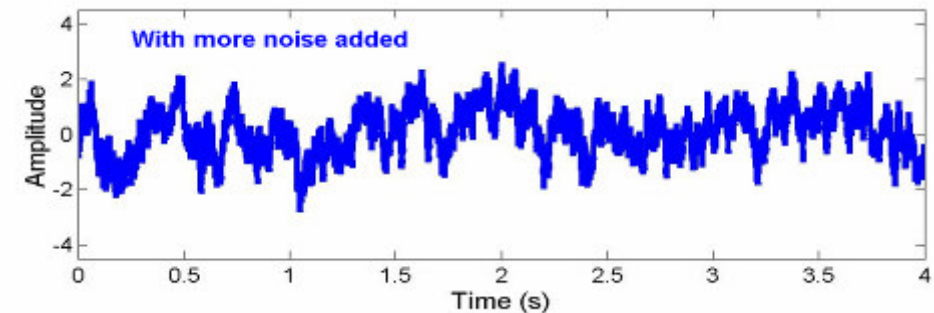
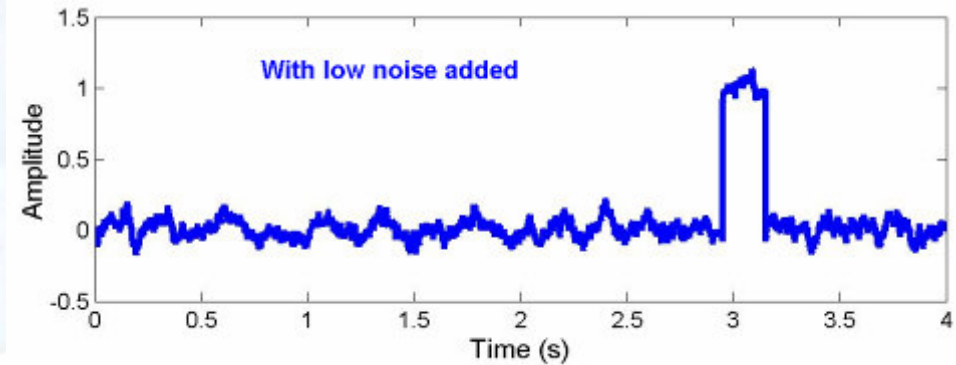
Re-cap - Acoustic Digital Spread Spectrum (ADS²)

- **History**
 - Spread spectrum signalling is in daily use in satellites and mobile telephones – it is not a new technique
 - Nautronix presented on this technology to FFU in 2006
- **Concept**
 - ADS² is a broadband signalling technique
 - Uses coded (pulse compression) signals ‘spread’ over 3 kHz
- **Advantages**
 - Longer range for lower power
 - Very accurate Time of Arrival detection
 - Immunity to interference
 - Very high signal integrity
 - Good performance in poor signal / noise environments
 - Multiple signals can co-exist in the same environment simultaneously
- These factors are at the core of the technique’s suitability for use in subsea control and monitoring applications

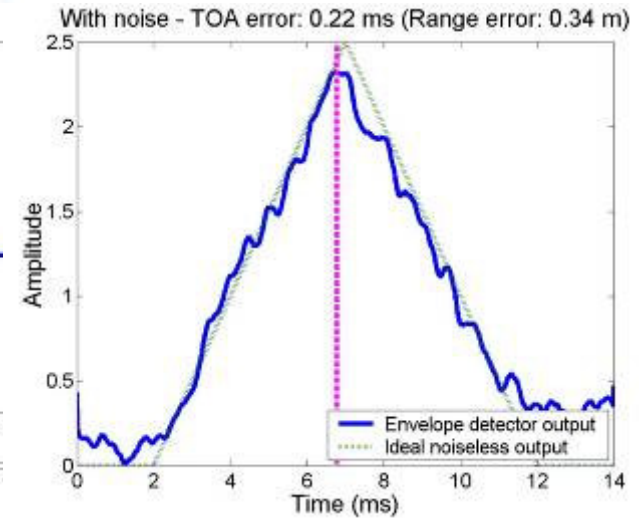
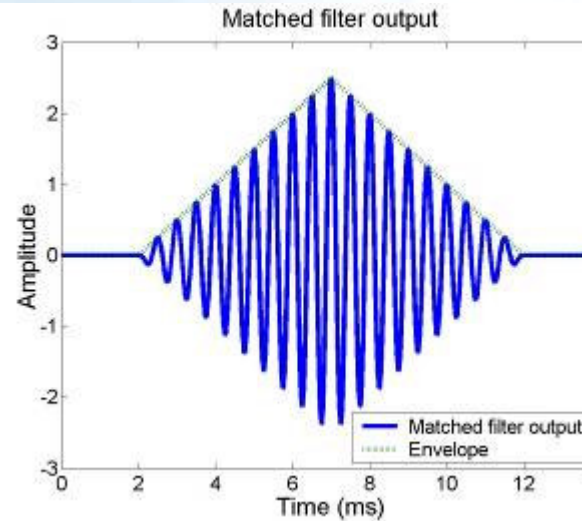
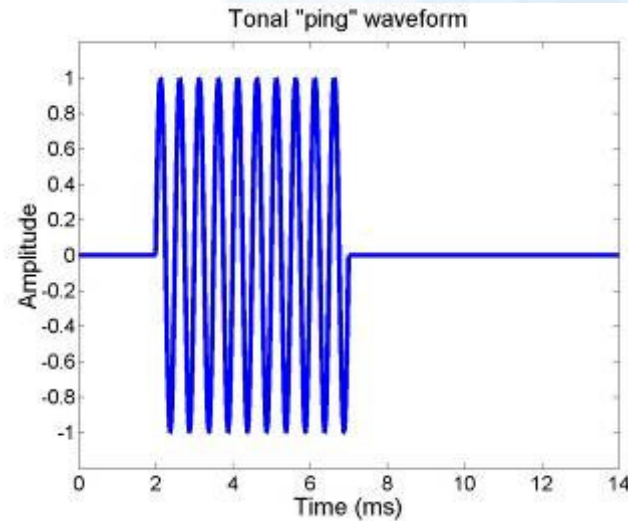
Signal pulse detection – ‘traditional approach’



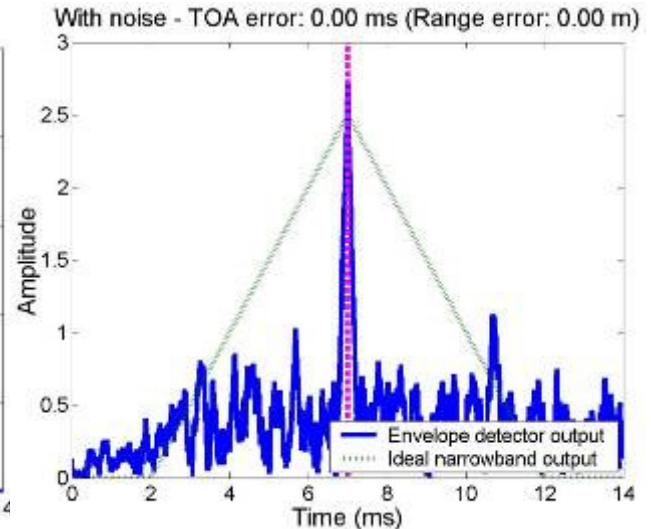
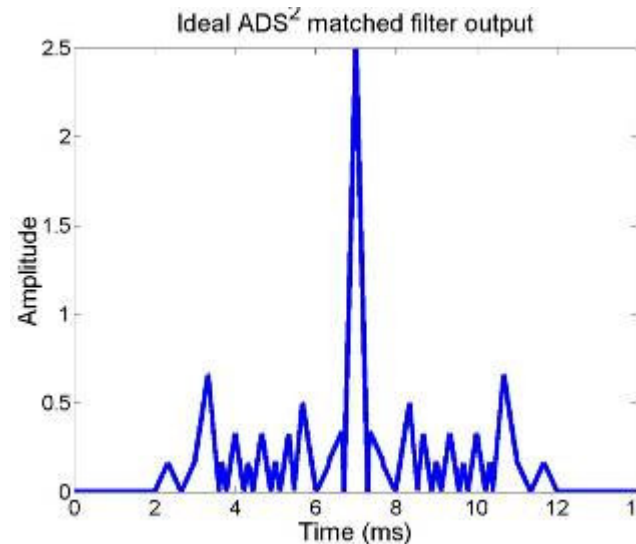
- The limitations of older forms of signalling, e.g. FSK, can be seen in these plots
- When noise is added, higher output powers are required; reducing battery life and increasing the noise pollution in the operational environment



Re-cap on conventional & ADS² signals



- The difference in detecting a conventional signal and an ADS² signal



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So much for the theory...

...but what about the reality?

Example – communication & positioning (NASNet®)



- Cockburn Sound, Western Australia
- Average 20 m water depth
- One NASNet® station at each corner of a 3 km x 2 km rectangle
- Positioning within 1 m of DGPS to 5.7 km outside the grid



Example – subsea control

- **NASBOP (Nautronix Acoustic Subsea Blow Out Preventor)**
 - Primary or back-up control system for BOP
 - Functions : 8 channels
 - Regular system status checks
 - Monitoring of valves, pressures, temperatures
 - Full system health-checks as required
 - Rated to 3,500 msw
- First system used for surface BOP control on 3 separate wells in 3,000 m of water in Brazil & Egypt



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NASBOP on SID on Stena Tay



Transducer

**Electronics
bottle**

**Cameron's
ESG**

(Use of video courtesy of Shell)

Acoustic applications - current

- **Command & Control**
 - Status monitoring
 - Control signals
 - Individual valves
 - Pre-programmed sequences
 - Redundancy & Primary control
- **Positioning**
 - Surface vessels
 - Subsea equipment
 - Manned, unmanned and structural items



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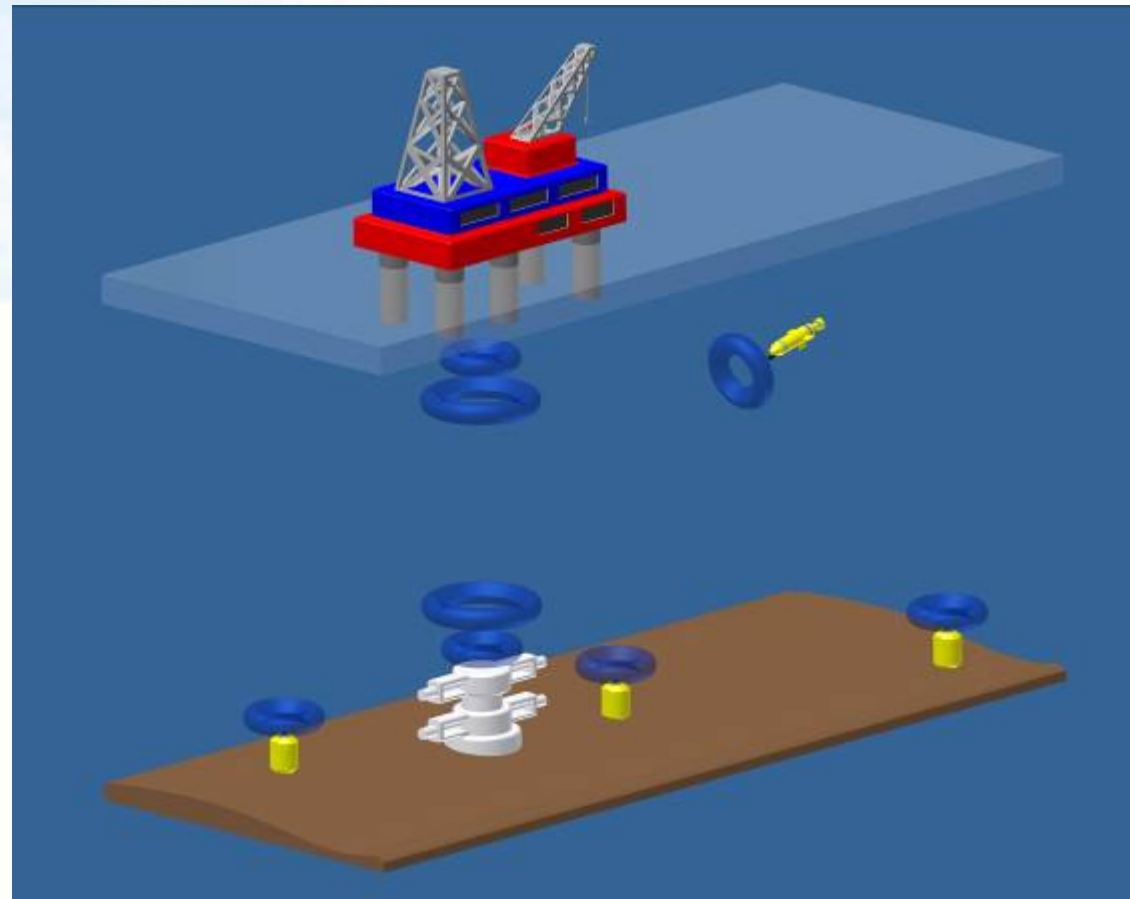
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Applications - future

- **Condition monitoring of subsea equipment**
- **Advanced command & control**
 - Many more control channels
- **“Replace the umbilical in a drilling situation with an acoustic solution”**
- **Far fetched ?**
 - Not from a communications perspective
- **More highly integrated positioning, telemetry and control applications**
 - Why use separate systems for everything?

Picture some of the wireless possibilities...

- Remove the umbilical
- Communicate with remote seabed units, and reposition them as required
- Communicate with ROVs, AUVs
- Install pre-production monitoring for wells
- etc.



Mobile telephones & Life of Field comparison



- **Mobile devices have evolved from voice-only to include:**
 - SMS for text messaging
 - e-mail
 - Internet access
 - Sending and receiving pictures
 - Video
- **Once the basic infrastructure was in place, more and more layers of application were added**
- **Life of Field can benefit from the same approach**
- **Install the infrastructure for one acoustic system to provide:**
 - Positioning (at all stages of field development)
 - Telemetry
 - Environmental monitoring
 - Control and monitoring of subsea equipment
- **Layer the applications and leverage more benefit from the underlying system**

Would a control operation benefit from acoustics ?

- **Some of the questions that should be considered**
 - **Slant range**
 - Depth & stand-off – what subsea gear lies within a given radius of the rig or production platform?
 - **Channels / functions**
 - What is to be controlled or monitored?
 - **Sample rates**
 - How often is the information to be collected?
 - **Data rates / duty cycles**
 - How often is the information to be displayed (update rates)?
 - **Duration**
 - How long does the requirement / operation last?
- **The answer could be an acoustic system**
- **Think about what needs to be done, not how things “have always been done”**

Summary

- Subsea acoustics have come a long way since Fred and Barney started sending messages
- Advanced systems offering high reliability, signal integrity and resilience are a reality and are being used in control, telemetry and positioning applications today





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Animation



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A short animation to show what is being achieved with subsea acoustics; covering telemetry, positioning, communication, monitoring and an integrated approach to life of field issues.





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Our vision is to be...



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