Weak signals, Far Horizons

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29052013
Astro far and weak

• We no can map (Planck) the CMB after 380.000yrs after the Big Bang, 13.8 Byrs ago

• We can see the mobile phone on the moon and identify it with the strongest radio source on the sky (provided it is transmitting)

• We soon can do much more given all new planned observing platforms but..... society is changing
Not about Astronomy only
predictions 2001

1. E-business becomes M-business  OK
2. Mobile business now only in start-up phase  OK
3. No business through internet is misjudgement  OK
4. Content becomes most important in virtual world  OK
5. Energy saving technologies have a great future  OK
6. Wireless telematics = future  OK
7. Electronic fraud rapidly increasing; future for encryption and identification  OK
8. In 2005: 1 Billion wireless internet users  OK
9. “Being wireless” becomes lifestyle  OK
10. Advanced track and trace applications  OK?
11. Our second nature: real time palm video in full colour  OK?
12. Ergonomics: simplicity, ease of use, design, fun, accessibility  OK
13. Mobile phone becomes also Cashphone  about OK

Note: No facebook, twitter, Android as enabling platform etc.; Seredipities shape the world

Courtesy: AvA from Harry Bosch/Syntens2001
Trend to “farm out” Industrial R&D (i.e. risk dumping to Universities) require more public funds to (applied) science as a consequence, not less

- More balance between core/base knowledge and societal benefits (applied)
- Essential for Unknown-unknowns (leading to serendipities) and known-unknows
- Endless examples of hugely important serendipities (penecilline, magnetron, dynamite, velcron, 3M, X-rays for diagnostics, Poly-ethylene etc., etc.), **same in astronomy!**
- Innovation is a confrontation with ideas to the market; not a design (although lead-up time could be long though, ask John O’Sullivan, 20yrs?)
## Emphasize and Educate: Some Contributions of RADIO ASTRONOMY (TECHNOLOGIES) TO OTHER FIELDS

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<td>Very Long Baseline Interferometry</td>
<td>Most accurate (hydrogen maser) clocks</td>
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Modified AvA, Courtesy Simon Garrington
ASTRO R&D: Remain on the ball;
Other developments over last ten+ years
(besides f-book, twitter etc.)

- From fixed channel to CDMA; Qualcom now 115B$ company
- SAMSUNG is introducing a 5G network
- D-Wave launches 521 QUBIT computer
- From Mobile-to-Mobile to Internet of Things (M2M to IOT):

  Irwin Jacobs (founder) described as:
  *Made Q. successful by Passion and Persistence*
...and then Leadership; passion and persistence

“How the hell do I tell them I haven’t a clue where we’re going?”

“General Tendencies do not alone decide; great personalities are always necessary to make them effective”

Leopold von Ranke (Historical writer 1795-1886)
Therefore: It is about Astronomy+.

Some predictions for 2023

• Realization of ambitions for RadioAstronomy depend on how well societal benefits have been made clear
• SKA2 to be finished before 2025
• Rethink High Frequency SKA as global project: Is same as ALMA-low (15-150GHz); to be build in South America for 2025-2035 period
• U-LOFAR on the backside of the moon serious project
• ASTRO technology education track in Dutch (technical)universities
• Strengthen the connection between “Space” and “Earth” Sciences as collaborative aim

• But then, who can really predict the (near) future…..
In Concluding

Impressive and Incredible progress made in available instruments for ASTRONomy with more to come and proud and pleasure to have been some part of it all

Challenges are great at all levels “as usual”when “dipping” into unknown territories structurally, financially and otherwise but confident that all the great works and ideas will work out!

Thanks a lot to all the speakers of today, the SOC, the LOC and in short all who made this event so memorable

Thanks a lot to the many good and great collegues and people I was happy to have met over the last decades at ASTRON and elsewhere!!
Thanks also my “enablers”; my wife Els, children Boudewijn, Nora en Eva and their partners Dominique and Timo, for their patience and endurance.