



## FutureFarm: The European Farm of Tomorrow Strategic developments of agricultural robotics

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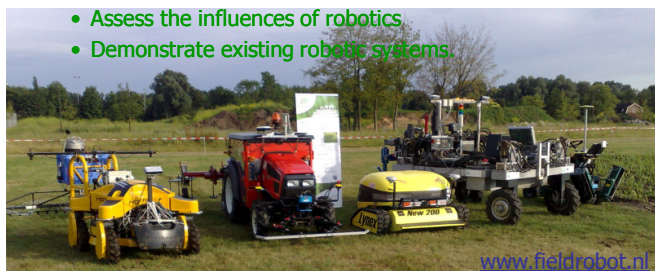
## FutureFarm: Aims

- Meet the challenges of the farm of tomorrow by integrating Farm Management Information Systems to support real-time management decisions and compliance to standards
- .....
- Demonstrate the potential of mobile robots
- Design a new robotic mechanisation system for European bioproduction



## FutureFarm objective Robotics

- *Energy efficient cultivation with light machinery, precision farming and robotics.*
  - Assess the influences of robotics
  - Demonstrate existing robotic systems.



[www.fieldrobot.nl](http://www.fieldrobot.nl)



## Existing small prototypes



University of Copenhagen,  
Denmark



Hortibot, SDU,  
Denmark



WUR  
The Netherlands



WUR  
Netherlands



CasmoBot,  
SDU,  
Denmark



University of Kaiserslautern,  
Germany



## Existing Tractor prototypes



University of Copenhagen,  
Denmark



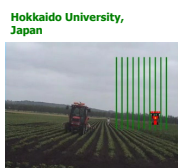
John Deere,  
USA



UniBots,  
UK



South China Agric University,  
China



Hokkaido University,  
Japan



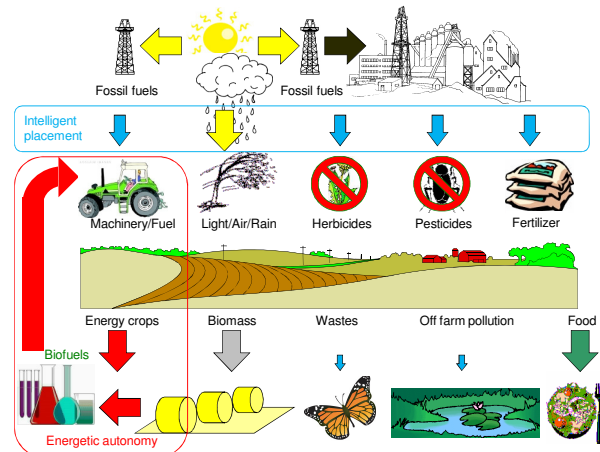
NARC,  
Japan

The Royal Veterinary and  
Agricultural University

Intra-row Weeding with a  
Cycloid Hoe

Denmark, May 2006

- # Eight perspectives of agricultural robots



## Justification

- # System concepts

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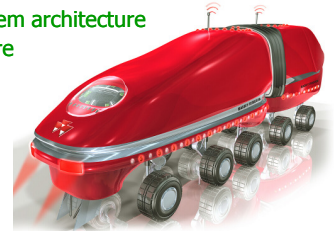


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## Mobile system requirements

- Small, smart, safe and reliable
- Informative communication
- Computational autonomy
- Energetic efficiency
- Redundant modular system architecture
- Self awareness / safeware
- Defined behaviours
- Defined contexts
- Graceful degradation
- Integrated with FMIS
- ....



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## Intelligent machines

- "Our definition of intelligence is so anthropocentric as to be next to useless for anything else" (Samuel Butler, 1887)
- Central paradox of artificial intelligence:
  - Systems simple enough to be understandable are not complicated enough to behave intelligently;
  - Systems complex enough to behave intelligently are not simple enough to understand.
- **BUT we can make machines appear intelligent in defined contexts**
  - "Sensible unattended behaviour, over long periods of time in a semi natural environment, while carrying out a useful task"
  - Use *a priori* knowledge to optimise tasks
  - Use reactive behaviours in unknown situations (but defined contexts)
  - Expert system to define context in real time
  - Expert system to select suitable behaviour based on trigger event and current context
  - Have the ability to be self aware (safeware)
  - Graceful degradation through appropriate behaviours (redundancy)
  - Giving us a system that is sophisticated enough to deal with real world complexity



## Conclusions

- Equipment is going to get smarter
- Develop system architecture to meet requirements
- Move robots out from laboratories for long-term practical tests
- Design and build a complete new small smart mechanization system
- Cross and multi-disciplinarity between 'pure' roboticists, agricultural engineers and agronomists
- Please visit [www.FutureFarm.eu](http://www.FutureFarm.eu)



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