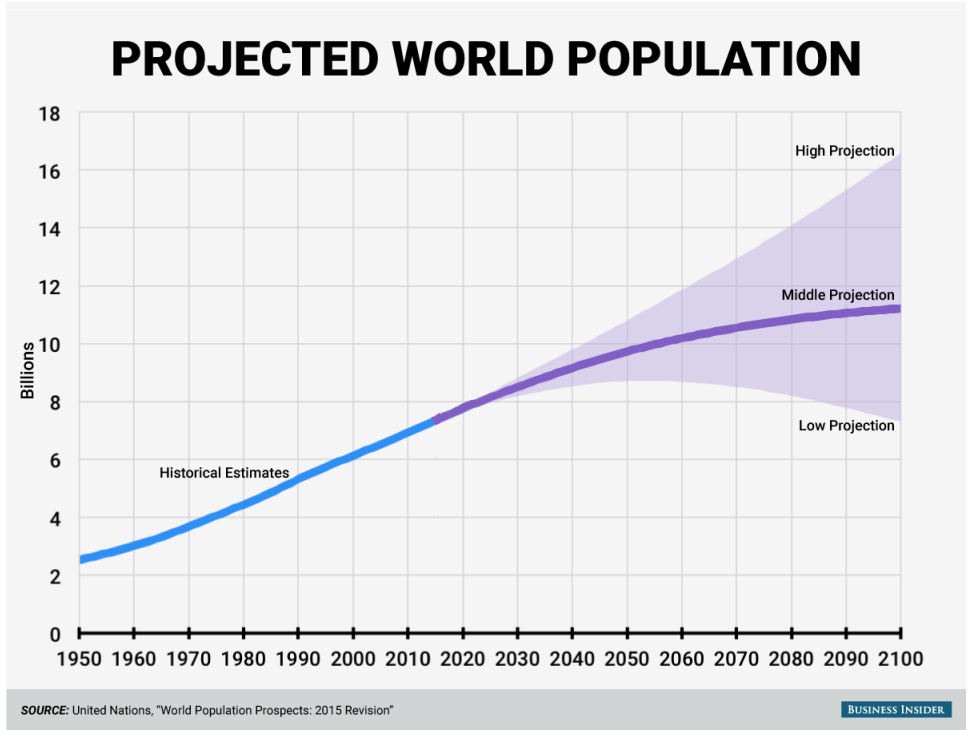
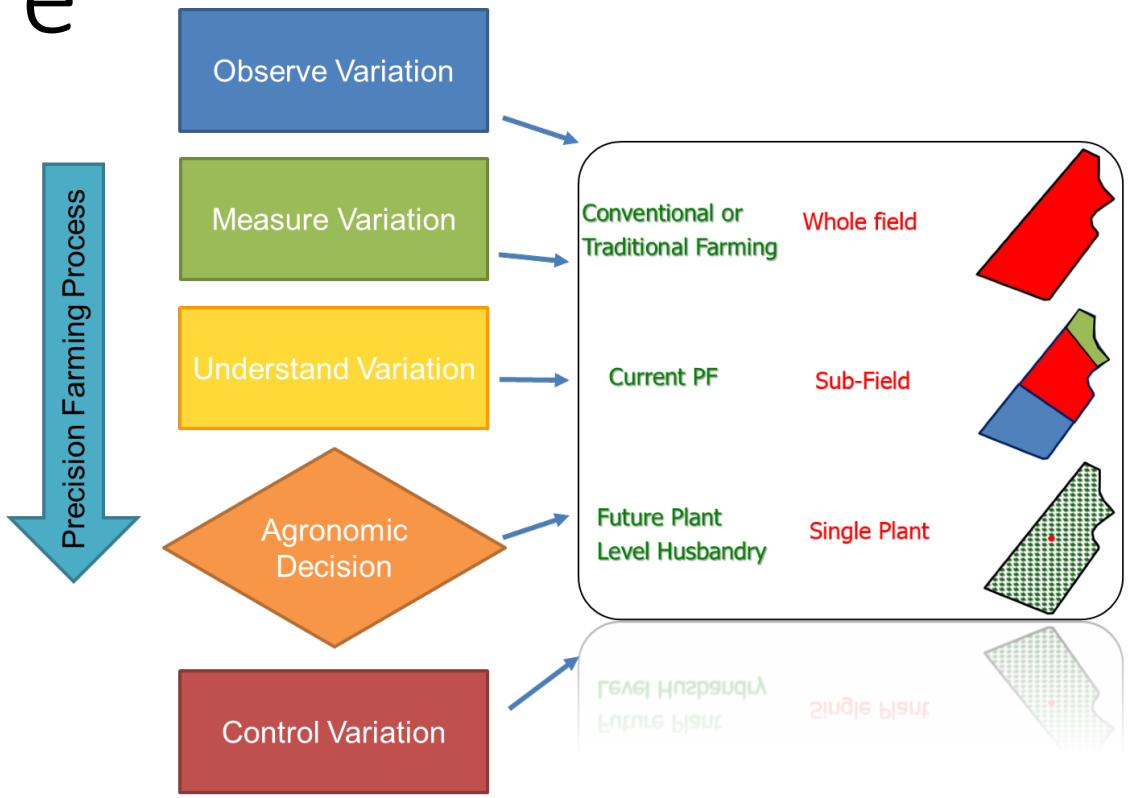
Lee Williams – Agri-EPI Centre Manager

Current aims of agriculture





- To feed a growing global population with reducing resources
- Improve sustainability: reduced waste & increase efficiency
- Adopt Precision Farming management methods: **4x Rights**

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Agricultural problems

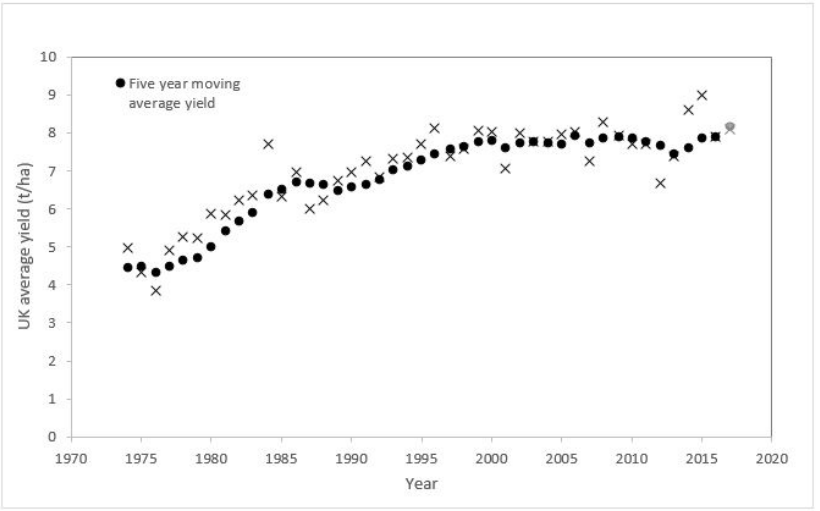
Reduced rural labour **=** ever larger machines

Limited time windows **=** ever larger machines

One-upmanship = ever larger machines

Lack of resolution for PF **cause** large machines

Compaction limiting yield **cause** large machines



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A small robotic future

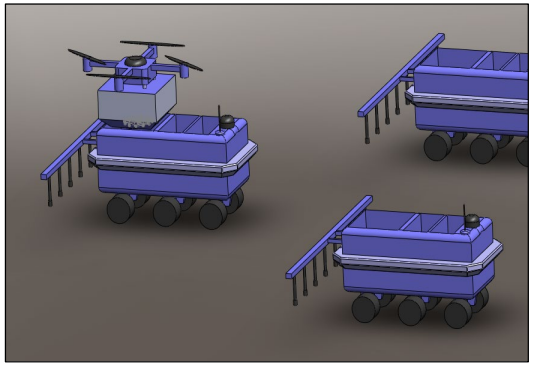
Increased resolution = improved PF = margin gain?

Reduced compaction (tackle cause) = increase yield?

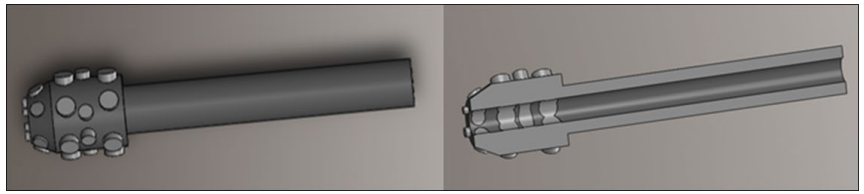
Robots operate in “swarms” = same area covered

Swarm requires management = job retained

Small vehicles are intrinsically safer



1875 ton/ha to 11.27 ton/ha

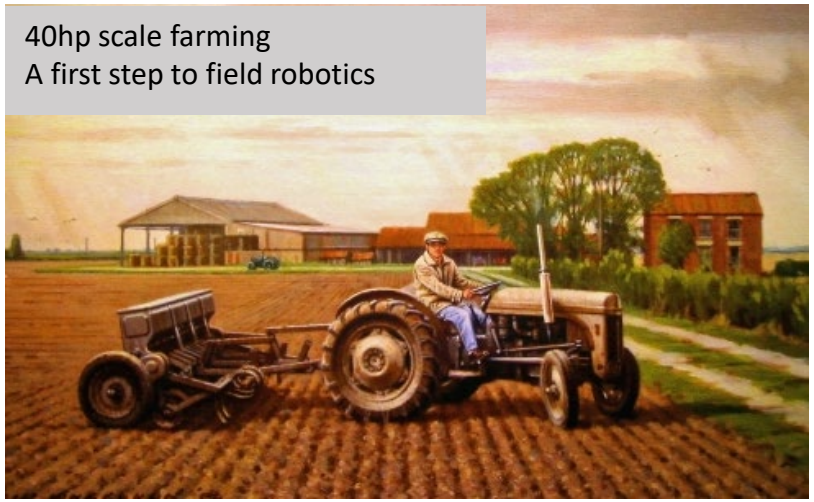


Over a 150 times reduction in soil movement

Energy implication???

Future plant scale robotic management

40hp scale farming
A first step to field robotics



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Hands Free Hectare – A World First!

Project outline

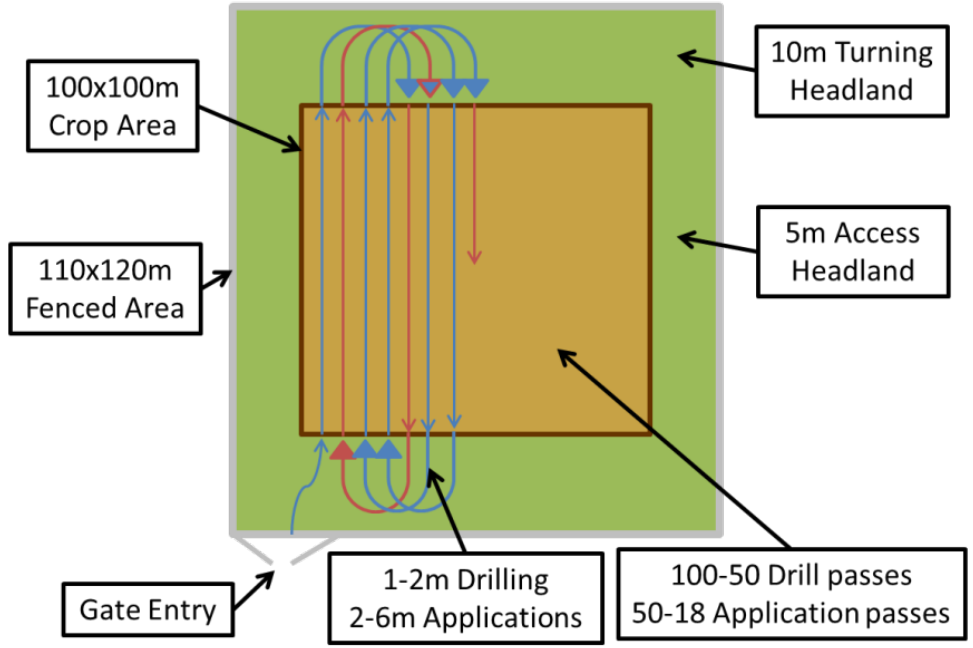
"Automated machines growing the first arable crop remotely, without operators in the driving seats or agronomists on the ground"

Project objective

1. World first automated field growing cycle: drilling, husbandry/agronomy and harvest
2. Challenge perception of automation capability and inspire through media coverage
3. Utilising machinery and technologies that are available and affordable **not** bespoke and expensive:

   Commercial compact Ag machinery

   "Open source" automation
4. 1 year project…. One chance - KISS!!



Level ground

No people

No obstacles

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Hands Free Hectare – infrastructure

Middle Leasow


Safety fence


Ha and boundary layout


Field “mission control”

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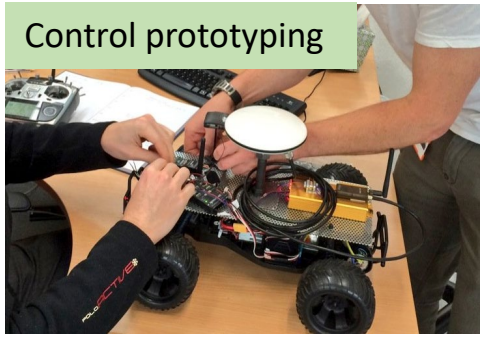
Hands Free Hectare – equipment

Control prototyping



Control actuation

Tractor 38Hp

Steering actuation

2m Combine harvester

6m Sprayer

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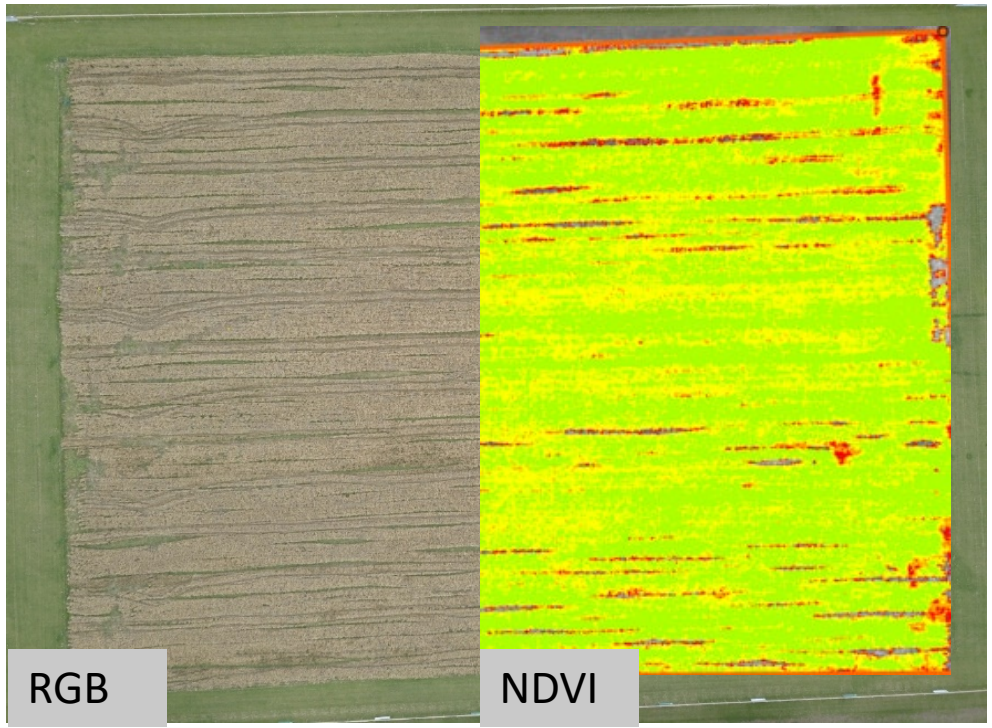
Hands Free Hectare – agronomy



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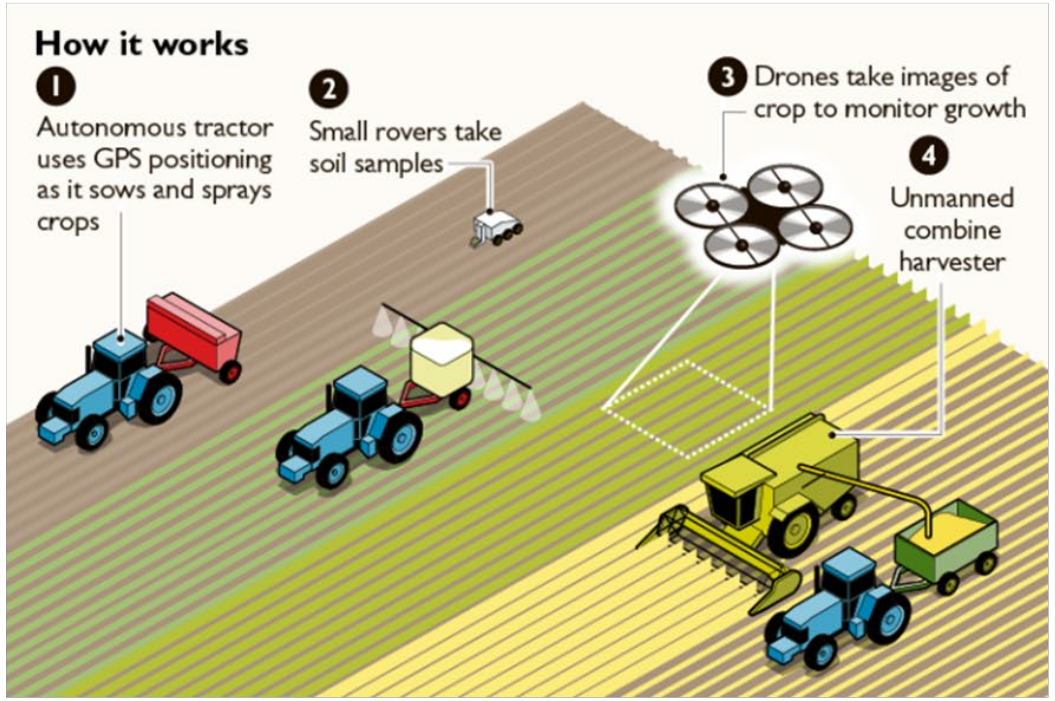
Hands Free Hectare – field operations



The Times September 6th 2017

- Pre-seed blanket herbicide 6th April
- Plant & Fertilise 25th April
- Roll 28th April
- Fungicide 1 5th May
- Fertilise 25th May
- PGR and micro nutrients 7th June
- Selective herbicide 9th June
- Fungicide T2 3rd July
- Pre harvest desiccant 15th Aug
- Harvest 6th Sept

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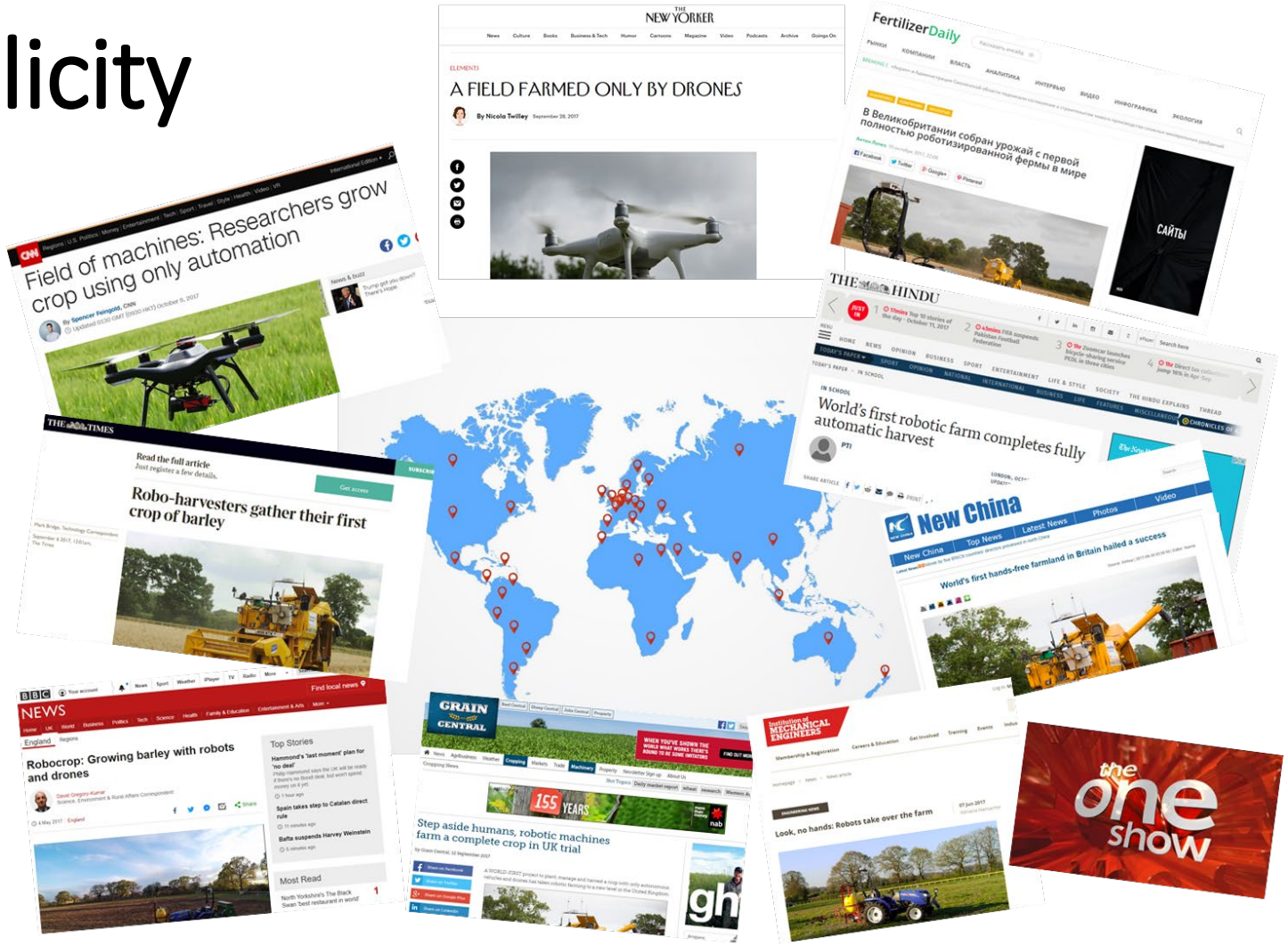
Impact – “good” publicity

- **Twitter**
  - 2,641 Followers
  - Permanent Secretary of Defra
- **Facebook**
  - 1259 Followers
  - Posts reaching 40,000
- **YouTube**
  - 335 Subscribers
  - 78,000 Views



Publications across **85+ Countries**

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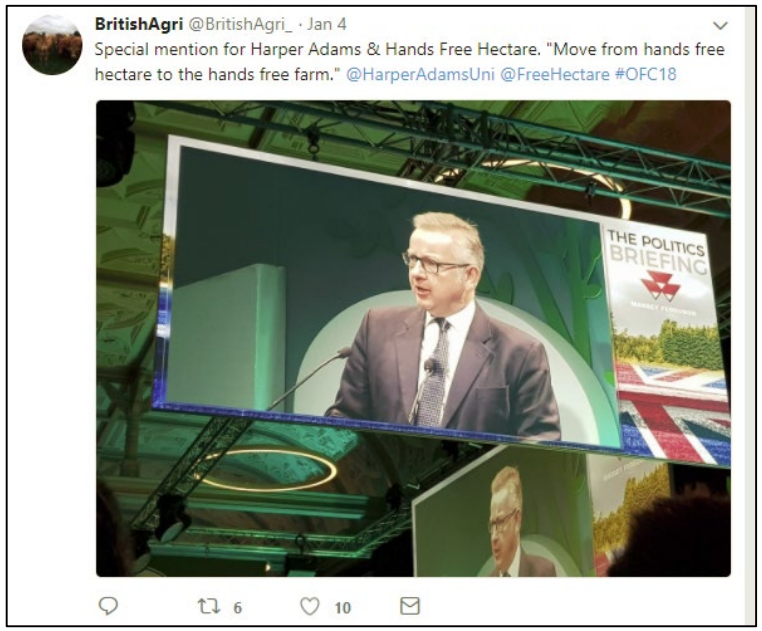
Keep evolving and telling the story

What to do with 4.5 tons of Barley… BEER?

		Results	Sample	Threshold	% of Threshold
Nitrogen	%w/w	2.27	22700	19000	119
N /S Ratio			15.5	17	91
Phosphorus	%w/w		4074	3500	116
Potassium	%w/w		4811	3800	127
Calcium	%w/w		956	300	319
Magnesium	%w/w		1356	800	170
Sulphur	mg/kg		1463	1100	133
Manganese	mg/kg		14.5	20	73
Copper	mg/kg		4.7	2.5	188
Zinc	mg/kg		28.7	20	144
Iron	mg/kg		70.7	No guidelines	
Boron	mg/kg		3.7	No guidelines	

Gin

Impact – political



Department for Environment Food & Rural Affairs

Health and Harmony: the future for food, farming and the environment in a Green Brexit

Case study: Harper Adams University

The Agricultural Engineering Innovation Centre and the National Centre for Precision Farming at Shropshire's Harper Adams University conduct research and provide support to improve our understanding of precision farming methods.

In September 2017, Harper Adams researchers, working with Yorkshire-based Small Medium Enterprise (SME), Precision Decisions and other industry sponsors, completed a world first. They had successfully grown a crop of barley using only autonomous vehicles and drones and without a human setting foot in the field.

The "Hands Free Hectare" project was a major step in revolutionising how we feed the world whilst helping to protect the environment. To limit damage to the soil for future harvests, and increase efficiency, the team employed a small modified tractor and combine equipped with cameras, sensors and GPS systems. Drones monitored the field, while a robot "scout" collected plant samples for inspection. This research has attracted world-wide interest in UK innovation in agricultural practice, prompting international partners to work with the team and resulting in news coverage in over 80 countries to date.

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Impact – Conferences & Awards

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Implication – Technology Requirements… Jobs

- Skilled Fleet Managers
- Agronomists – remote sensing
- AI & ML Programmers
- Agricultural Roboticists

- Communication infrastructure development

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New projects – CAV3 Fund

On Highway / Off Highway Communications and safety system Analysis

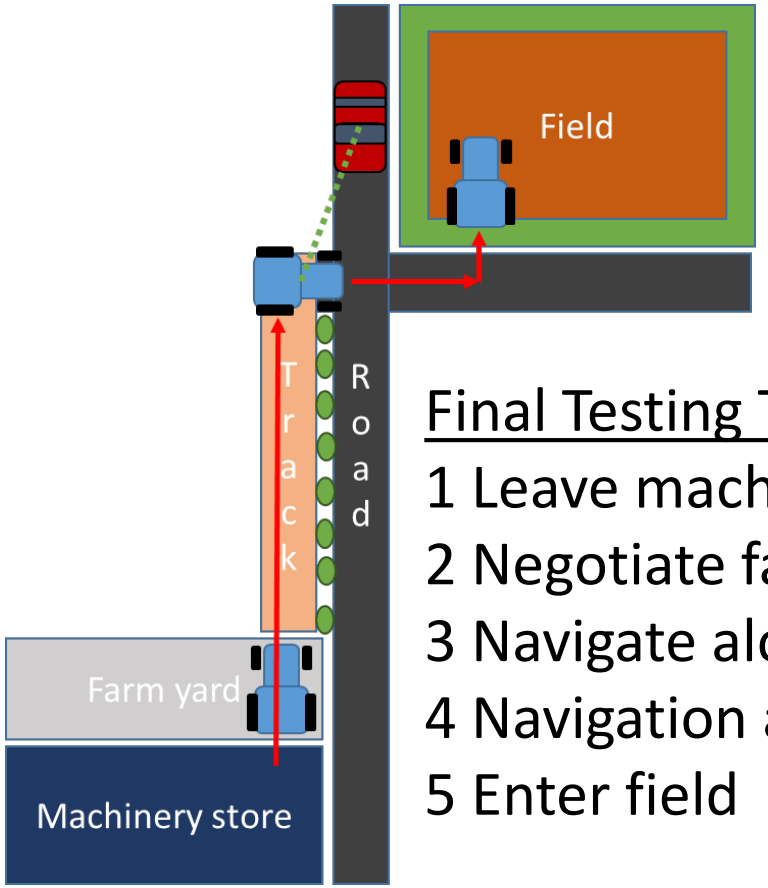
“Drive to field”

HFH teaming up with:

FARMSCAN AG

Considering:

- Autonomy to SAE4
- V2I and V2V communication
- SAFTEY



<u>Final Testing Task</u>

1 Leave machinery store
2 Negotiate farm yard
3 Navigate along farm track
4 Navigation along road
5 Enter field

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AI – Cheaper Precision Farming Tech

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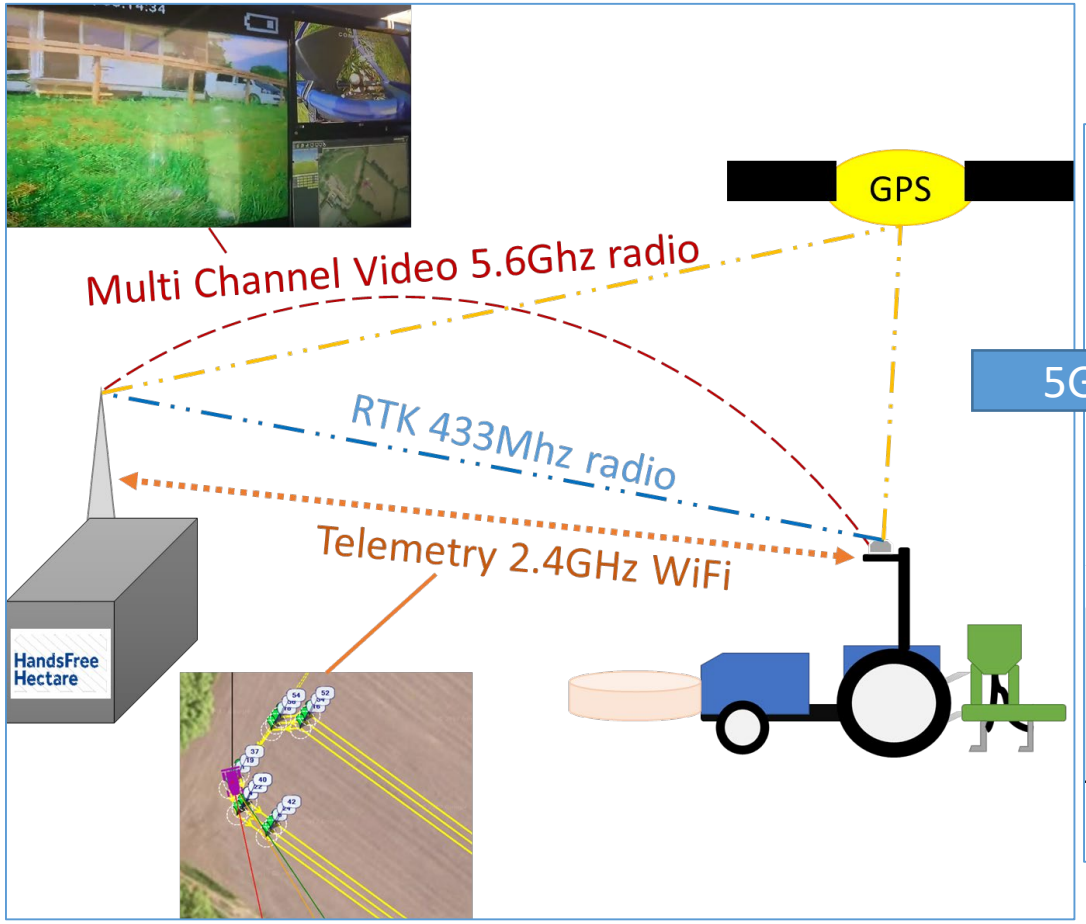
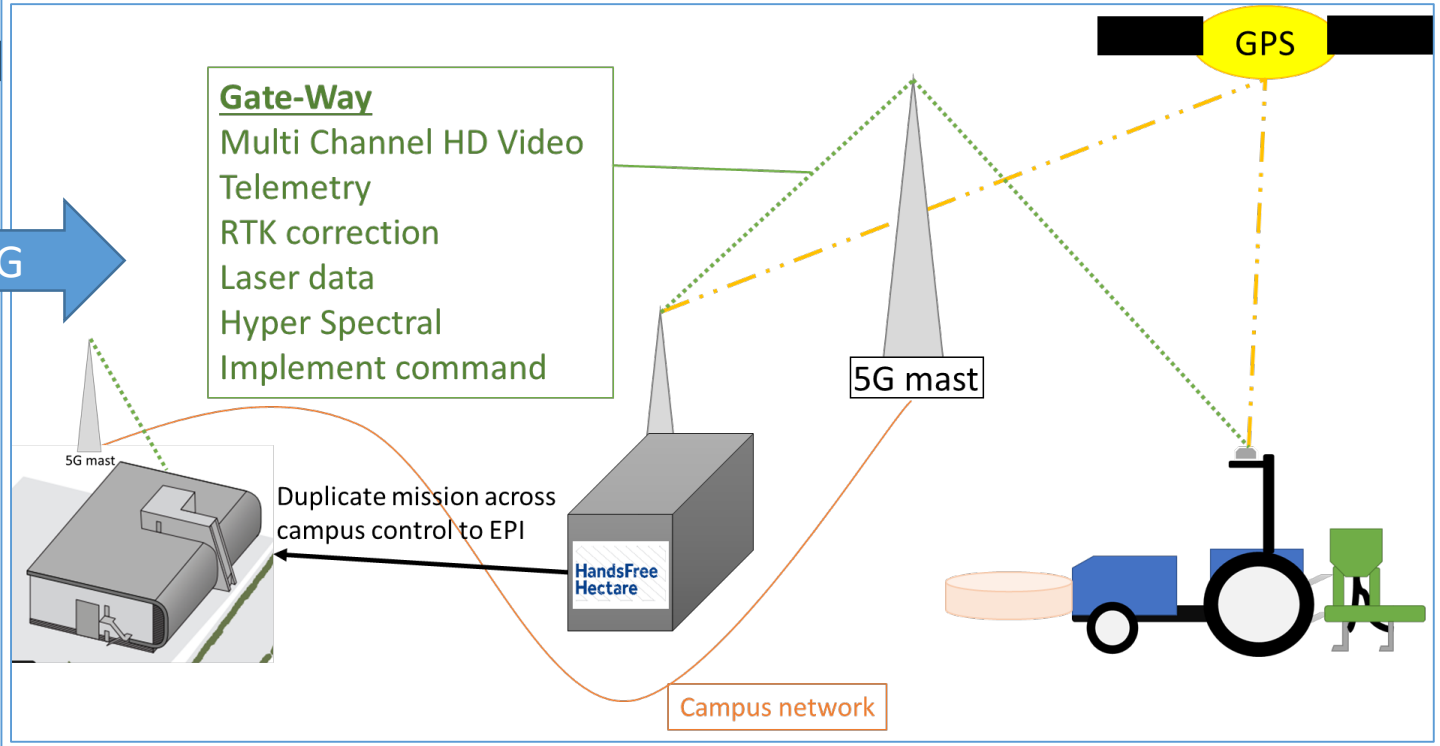
Rural 5G Connectivity

5G RuralFirst

5G promises:
- 100% coverage critical
- Low latency
- High data rates



5G



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For future updates and developments

@freehectare

Hands Free Hectare

Hands Free Hectare

www.handsfreehectare.com

worms.drones.hours

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