

HandsFree Hectare



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University**

The secrets of a successful collaboration

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

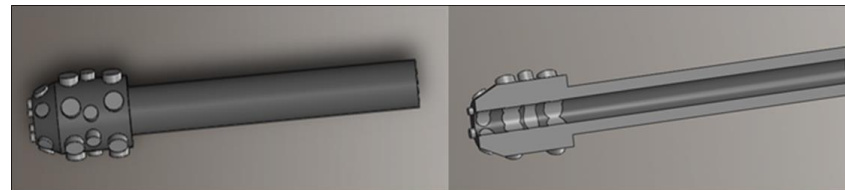
Small vehicles are intrinsically safer



Future plant scale robotic management

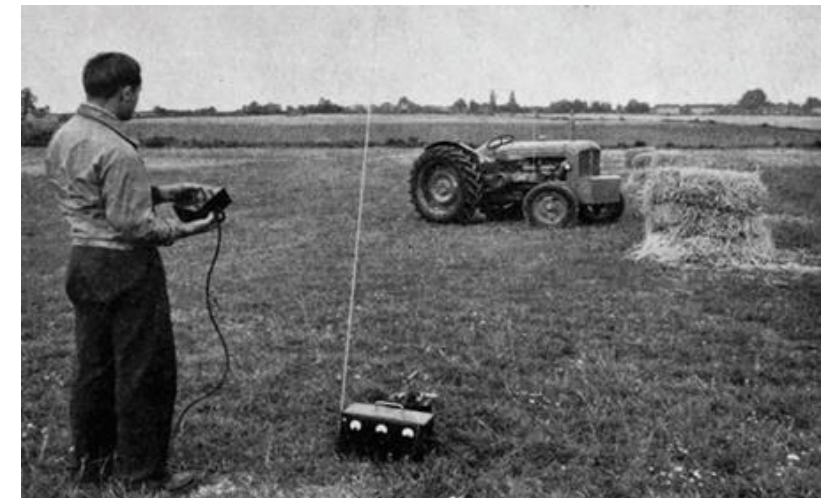
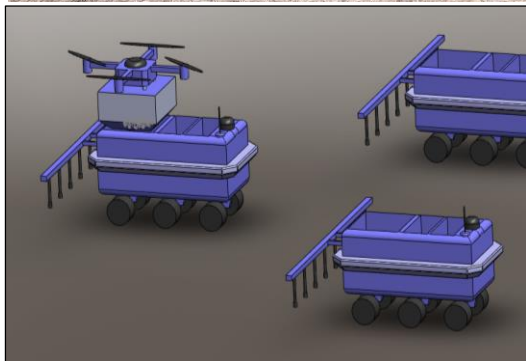


1875 ton/ha to 11.27 ton/ha



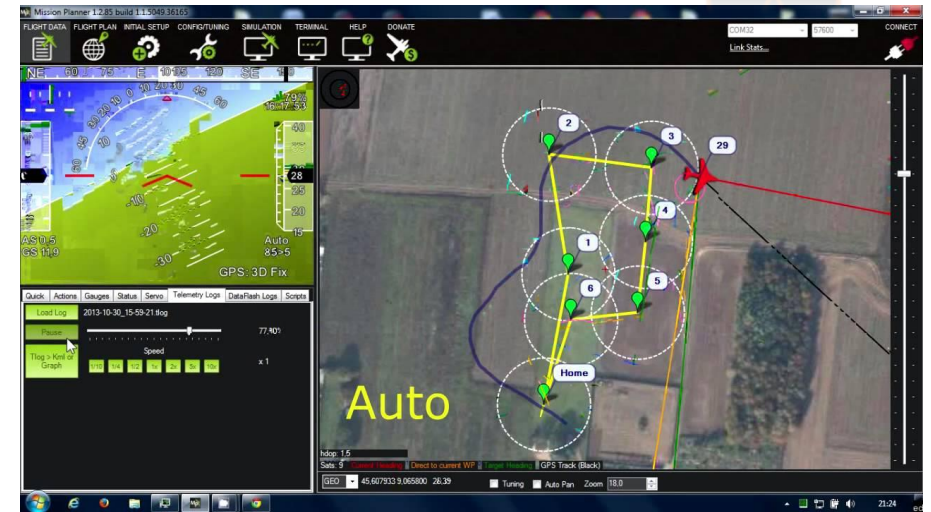
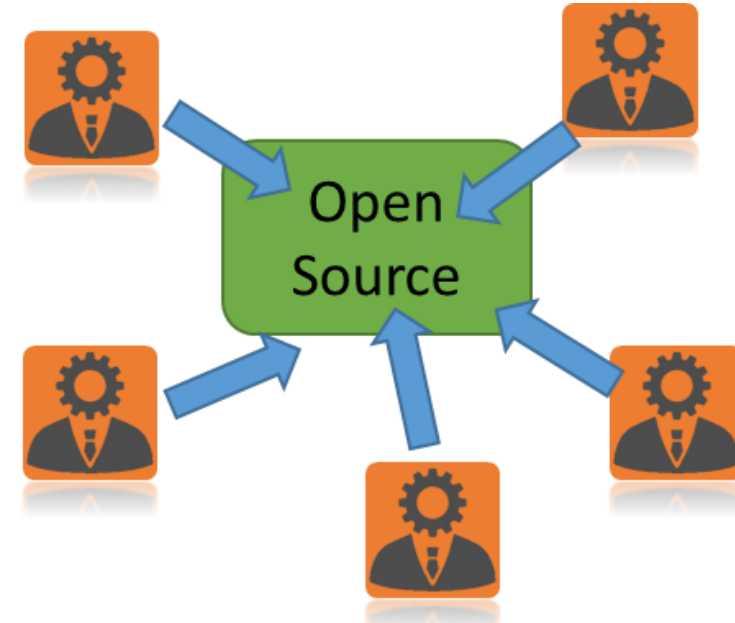
Over a 150 times reduction in soil movement

Energy implication???



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A different point of view



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Frustration with progress



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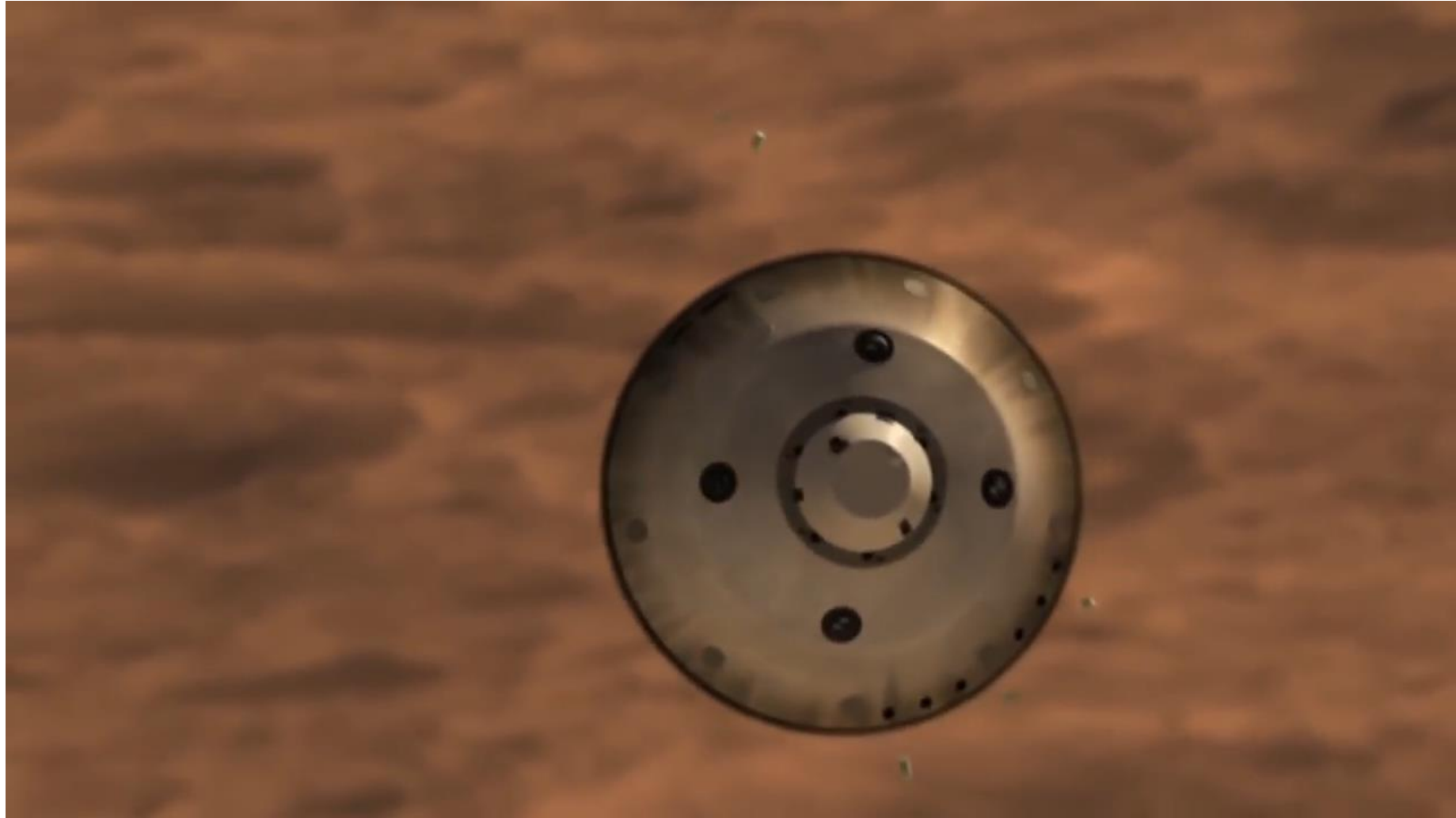


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Inspiration

NASA Curiosity Rover

Sourced: YouTube



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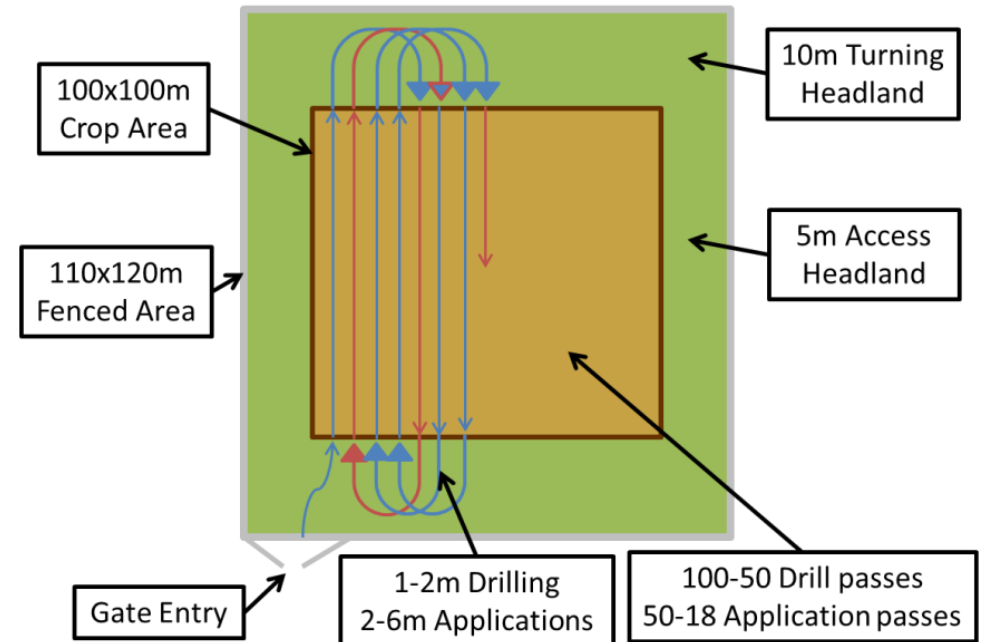
Hands Free Hectare – the idea

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



Clive Blacker – Precision Decisions

Practical background – Seeing is believing

There is no such thing as a DAFT idea - “you don’t learn until you try”

We have to challenge thinking different is not always wrong

You have to support and develop the next generation

Complementary expertise: Specialist solutions to improve farming performance.

Appreciates the DeRisking that Innovate offers

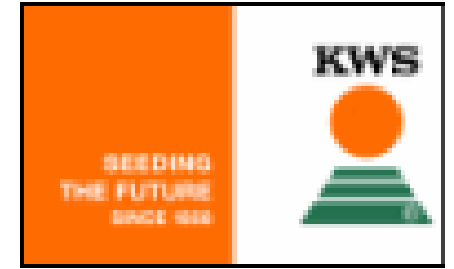
For the business its also the opportunity to bring in new skills and upskill existing Staff in new and emerging areas.



Martin Abell



Leverage commercial relationships



Erle Robotics



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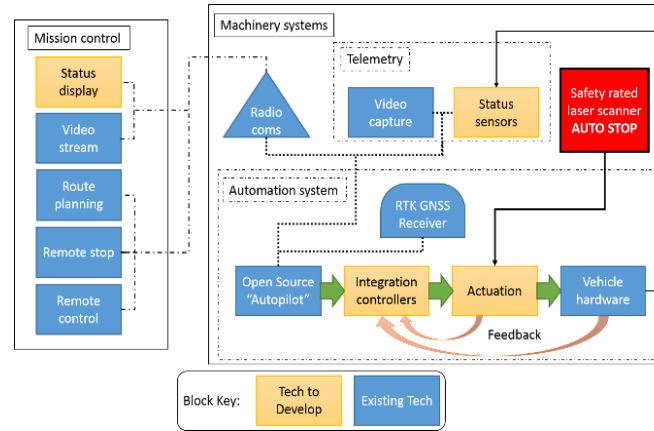


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Hands Free Hectare – FUNDED

WHY did they back us: **Innovate UK**

1. Strong Collaboration
2. World First
3. Value - £200k
4. Clear plan



Work package	Deliverable	Incremental steps	Start	End
WP0	01	Technical meeting	Sep-16	Sep-16
		1st Quarter meeting	Dec-16	Dec-16
		2nd Quarter meeting	Mar-17	Mar-17
		Launch of 'the marketing day'	Apr-17	May-17
WP1	01	3rd Quarter meeting	Jun-17	Jun-17
		Project review and evaluation meeting	Sep-17	Sep-17
		Specify the agricultural system	Sep-16	Sep-16
WP2	01	Specify automation system requirements	Sep-16	Oct-16
		Specify field site layout & infrastructure	Oct-16	Oct-16
		Specify all machinery requirements	Oct-16	Oct-16
		Specification of mission control system	Oct-16	Oct-16
WP3	01	Field selection and tenancy agreement	Oct-16	Nov-16
		Final site negotiation (tenure and normalisation)	Nov-16	Dec-16
		Selection and purchase of tractor and establishment machinery	Oct-16	Nov-16
		Selection and purchase of automation electronic components	Oct-16	Dec-16
WP4	01	Selection and purchase or development of crop protection machinery	Nov-16	Dec-16
		Selection and purchase of harvesting machinery	Dec-16	Jan-17
		Purchase of 'mission control' equipment	Dec-16	Jan-17
		Develop autonomous control of steering left / right	Oct-16	Dec-16
WP5	01	Develop autonomous control of forward / backward + speed	Oct-16	Dec-16
		Prepare safety stop system, Laser, Distance, Auto stop for forklift	Oct-16	Feb-17
		Prepare Tractor control system for integration	Jan-17	Jan-17
		Adapt manual driver controls with sub-control	Jan-17	Feb-17
WP6	01	Integrate auto pilot control system to tractor. Test on tractor	Jan-17	Feb-17
		Remote linkage control on / down. Test with tool	Jan-17	Feb-17
		Remote PTO control on / off. Test with tool	Jan-17	Feb-17
		Additional On / Off control output for spray system	Feb-17	Feb-17
WP7	01	Add in RTK GNSS functionality to allow mechanical accuracy	Feb-17	Mar-17
		Integrate automated drive control systems to harvester	Mar-17	Jun-17
		Remote harvest controls	Apr-17	Jun-17
		Test and setup of image system	Feb-17	Feb-17
WP8	01	Slitting field remotely	Mar-17	Mar-17
		Test and setup of drill system	Feb-17	Feb-17
		Chilling field remotely	Mar-17	Mar-17
		Remote application of fertilizer	Mar-17	Jun-17
WP9	01	Remote pre-emergence agrochemical application	Mar-17	Mar-17
		Remote of assessment of crop health	Mar-17	Jul-17
		Remote application of pre-emergence crop protection agrochemicals	Mar-17	Jul-17
		Testing and setup of harvest machinery	Jul-17	Jul-17
WP10	01	Harvesting of crops remotely	Aug-17	Aug-17
		Press release on the feasibility studies findings	Aug-17	Aug-17
		Feasibility report of open source technologies to automate field agriculture	Aug-17	Sep-17
		A report of system architecture	Aug-17	Sep-17
WP11	01	Investigation on the feasibility studies findings	Sep-17	Sep-17



Hands Free Hectare – collaborate successfully

1. Integrated autonomous working – Skunkworks
2. Weekly progress and planning meeting
3. Time and reputation pressure



Hands Free Hectare Harper Adams University Precision Decisions
DRIVING FARMING FORWARD

Hands Free Hectare: Progress report

Project quarter 1 Project week 3

Work package #	Deliverable #	Deliverable monitoring (current)	Deliverable title		
			Deadline	Progress (%)	Schedule (on, ahead, behind)
1	1	Specify the agricultural system	Oct	100	ahead
	2	Specify automation system requirements	Oct	75	on
	3	Specify field site, layout & infrastructure	Oct	100	on
2	1	Tenancy agreement in place	Oct	50	on
	2	Field site segregation (fence) and preparation	Dec	50	behind
	3	Selection and purchase of tractor and establishment machinery	Oct	40	behind
10	Liaison with in-kind contribution partners	Dec	25	behind	

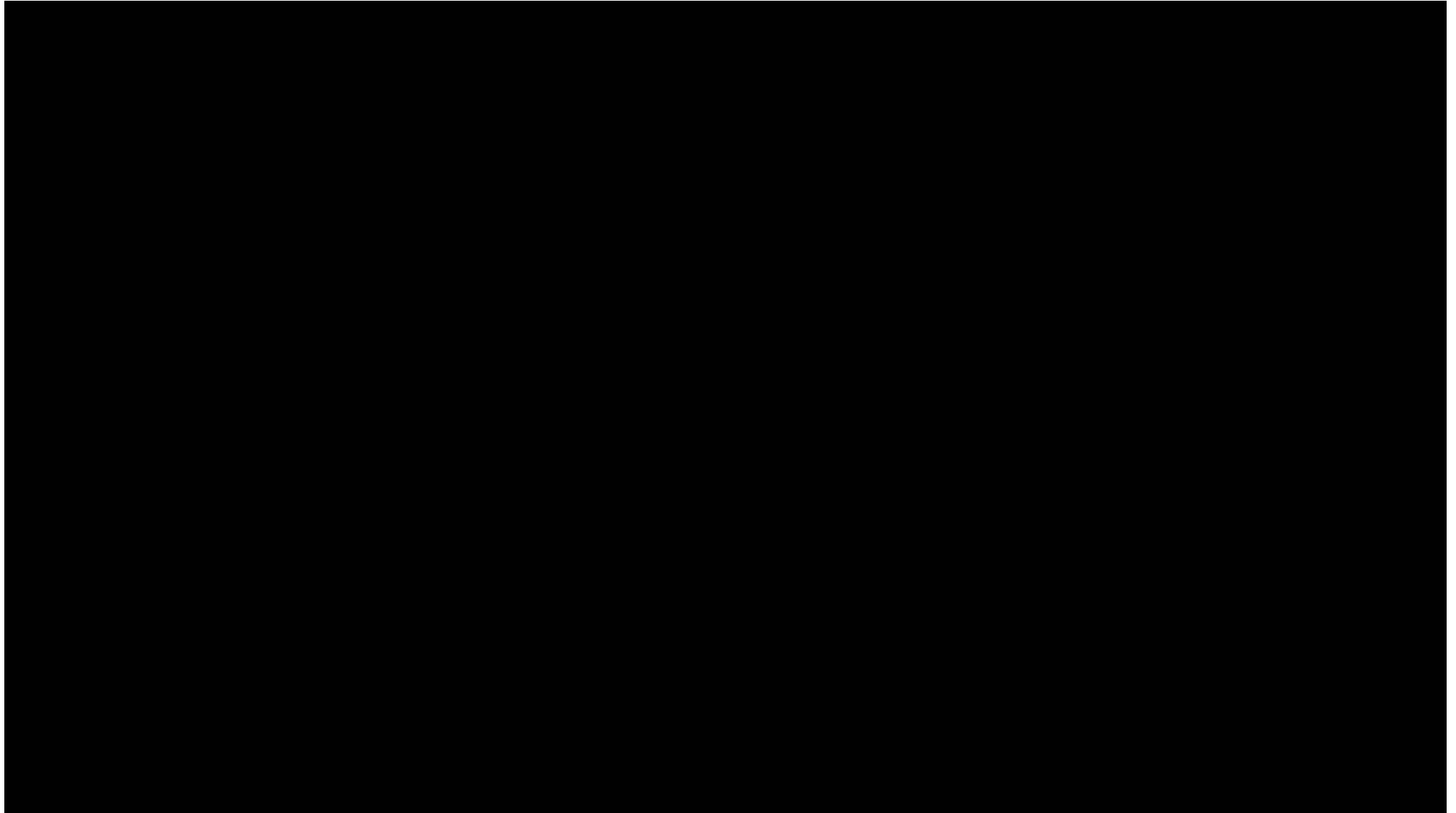
Progress: (broad comment on progress made since last report)
Social media has continued to move on with twitter work with ROS.
Martin & Jonathan have developed the automation system specification + continued to work with ROS.
Field site boundary has been seeded with grass by HAU Grounds team.
Kit gained contact with ISEKI UK, Clive has followed this with talks to secure tractor to be confirmed WK4.
Implement research by Mikey has found a suitable direct drill (1.5m) SimTech Aitchison.

Risks to register:
Time to receive tractor (key machine) once deal with supplier has been agreed – moved away from AGCO to ISEKI UK.
Official agreement (in print) for field is still required

Comment of overall project status: (+ve & -ve issues arising, timing changes, etc.)
Press release have been re-published 15+ times online also in print.
First deliverables have been met on time.
Positive progress going into the first meeting with monitoring officer.

Author name: Kit Franklin
Date: 21/10/2016

Hands free hectare - video



Outwood communication

- Regular press releases
- Regular multi platform social media updates
- Formal-ish press days with real work
- Mixed media – wide audience
- Take over GOOGLE!!

17/11/2016

0 Comments

Press release 1

Field to be farmed exclusively by robots - a world-first

In a world-first, members of Harper Adams University engineering staff, supported and led by precision farming specialist Precision Decisions Ltd, are attempting to grow and harvest a hectare of cereal crops; all without stepping a foot into the field.

The project entitled 'Hands Free Hectare' has recently got underway, with the team having to create their first autonomous farming machinery, ready for drilling a spring crop in March.



Keep evolving and telling the story

What to do with 4.5 tons of Barley... ~~BEER?~~ Gin

	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		



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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



Impact – “good” publicity

- **Twitter**

2,641 Followers

Permanent Secretary of Defra

- **Facebook**

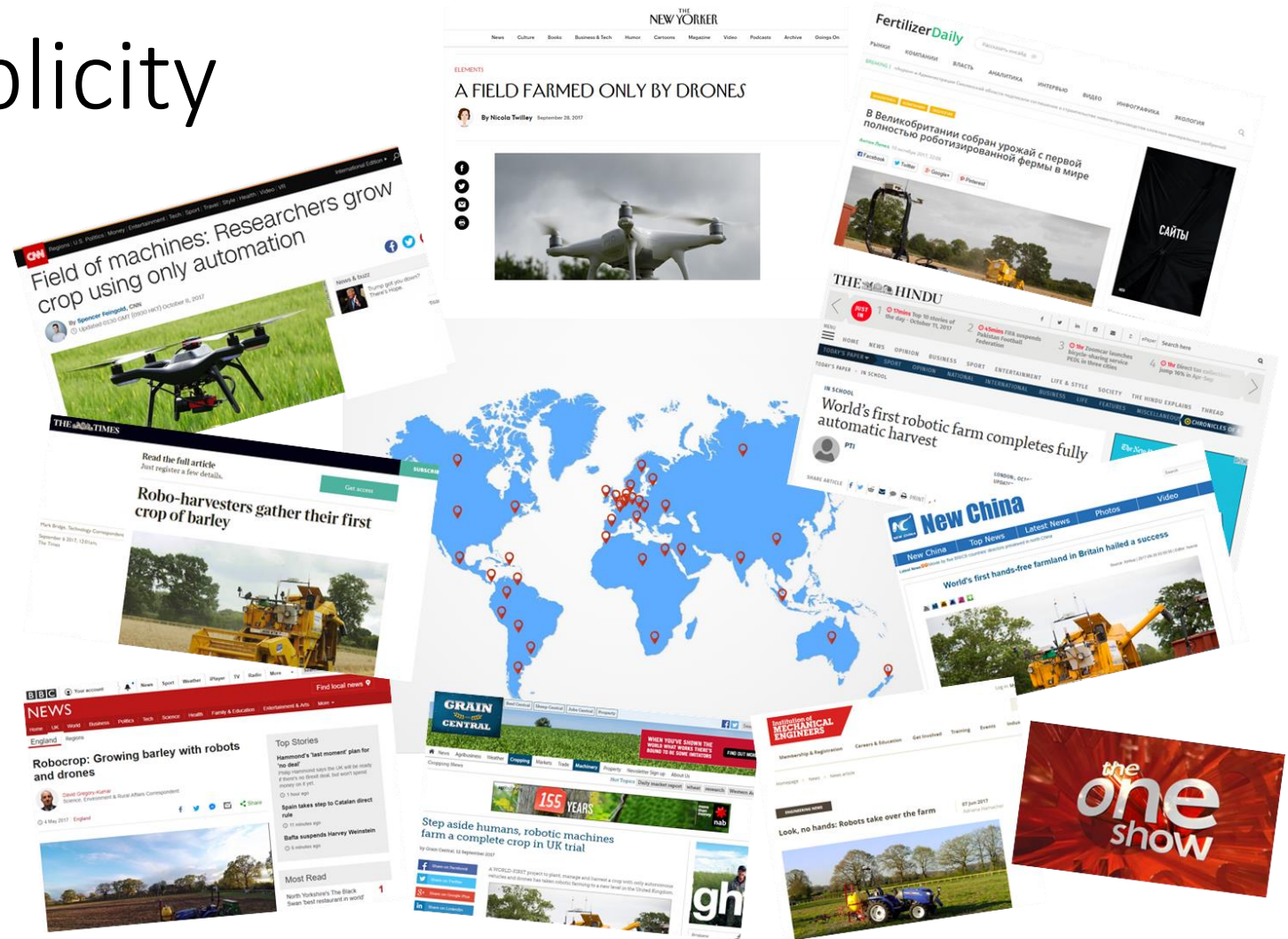
1259 Followers

Posts reaching 40,000

- **YouTube**

335 Subscribers

78,000 Views



Publications across **85+ Countries**



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Conclusions

Small team & budget innovation is possible

- “Skunkworks” model – SMEs & Corporates
- Collaboration
- Utilising technologies from other industry
- Harness the PASSION of the like minded



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For future updates and developments



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Hands Free Hectare



www.handsfreehectare.com



worms.drones.hours



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