

Delta-T Devices

Putting research into practice....

Dick Jenkins & Martin Goodchild

- About Delta-T Devices
- Collaborations, past & present
- The product development funnel
- Aspects of research, product development and transfer to the market



Delta-T Devices

**Leaders in Soil Moisture
Data Logging and
Plant Science**



Delta-T Devices

Founded in 1971

Approximately 20km from **Cambridge, UK**

Currently 35 employees

100% employee owned and co-operatively managed



Delta-T product areas:

- Soil moisture
- Data acquisition
- Environmental monitoring
- Plant sciences



ISO 9001
FS 565621



Delta-T International Sales

- 80-90% of revenue is from international sources
- Delta-T has over 80 distributors and agents worldwide
- Sales to China alone have grown:
 - £10k in 1995
 - over £1M today





Commercial/Academia Collaborative Products

In the beginning....

1974 John Monteith – Tube Solarimeter

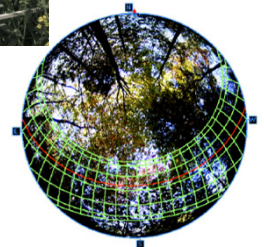
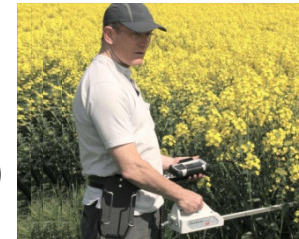
1976 John Monteith – Porometer (now AP4)

1990 Cranfield Uni. – Evapotranspiration software

1995 Macauli Land Use Inst. (MLURI) – Theta Probe (now ML2x)

1997 Peak Design – SunScan Crop Canopy Analysis

1998 Kansas Uni. – HemiView Tree Canopy analysis



More recently....

2000 Wageningen Uni. – WET Sensor, water content, EC & soil temp.

2003 CSIRO (Australia) – Root length analysis

2005 Peak Design – Solar Rad. Beam Fraction Sensor (now BF5)

2008 Peak Design – Sunshine Pyranometer (now SPN1)

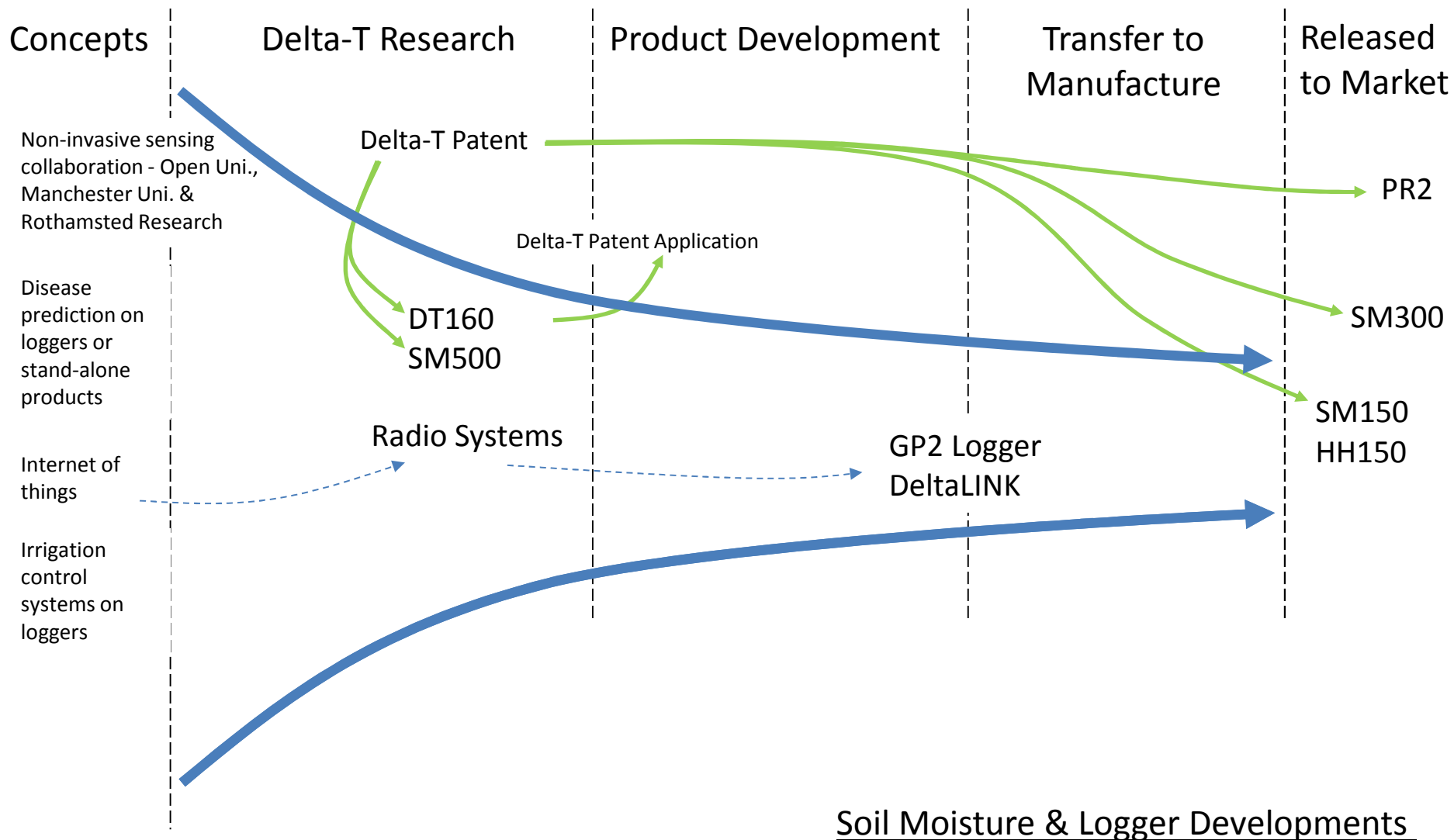
2009 Rothamsted Research – Prototype Soil Matric Potential DT160
mentioned in Prof. Beddington's presentation at e-Agri event, Manchester, 2011

2012 East Malling Research – TSB funded project to develop
horticulture & agriculture specific tensiometer products





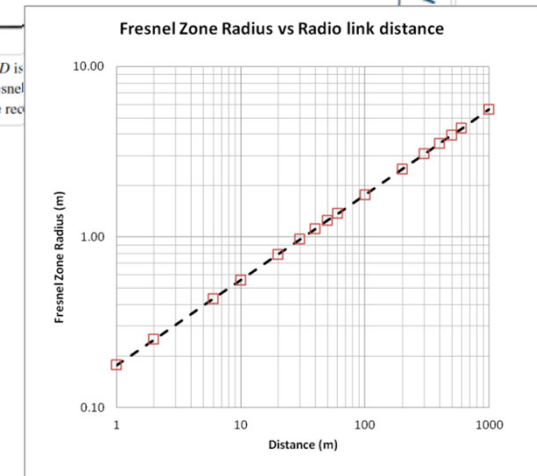
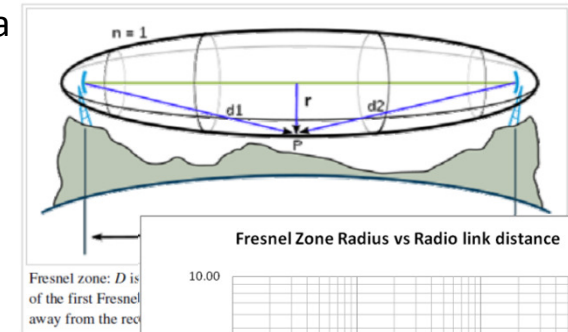
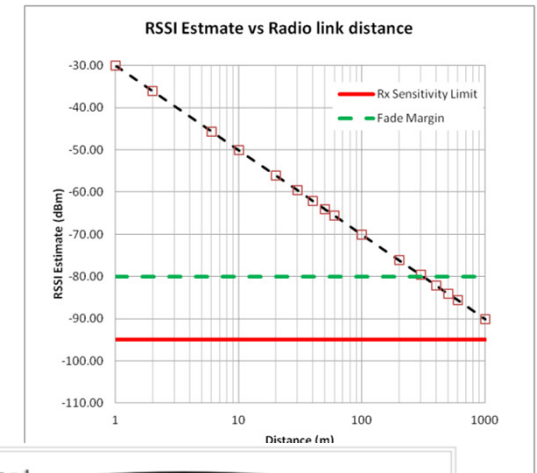
Delta-T's Development Funnel





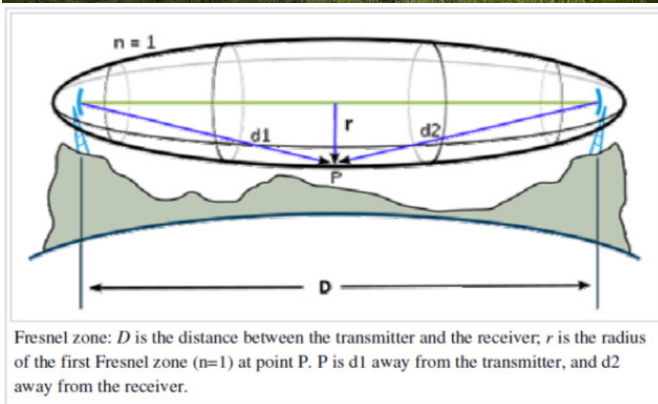
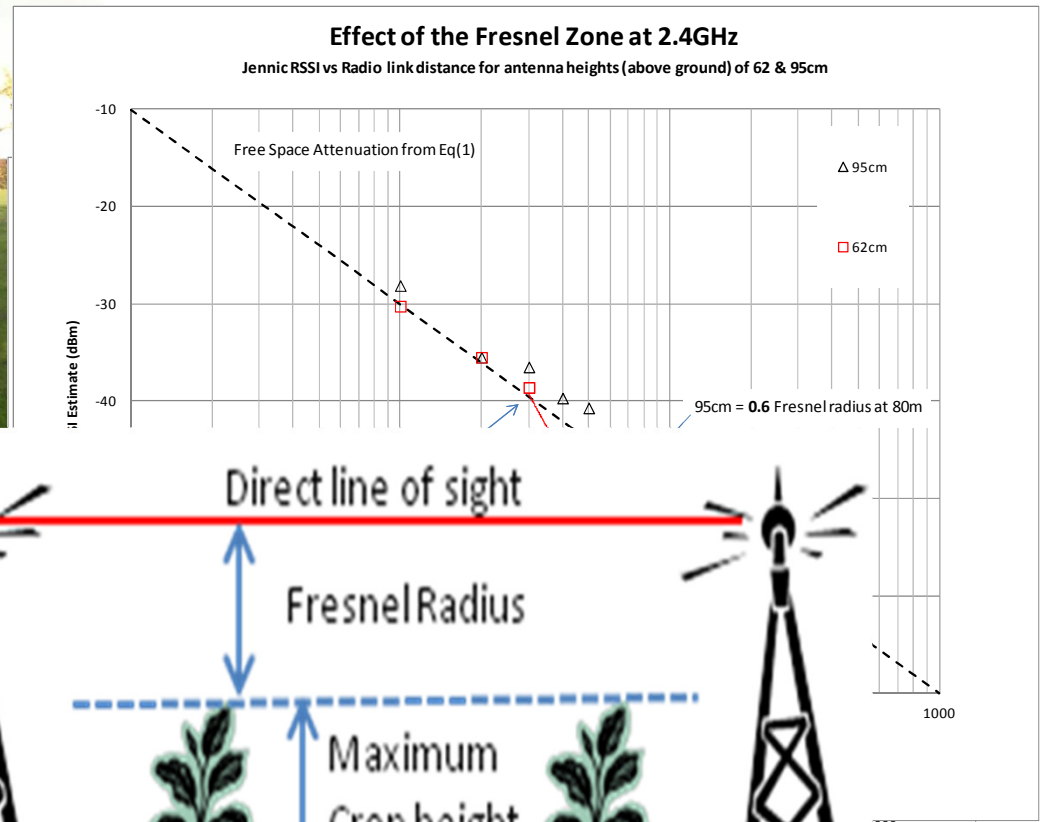
Radio Systems Research (1)

- Sensor \Leftrightarrow logger radio:
 - too many signal types and functions for a generic interface
 - cost per sensor
- Logger \Leftrightarrow PC radio:
 - use existing RS232 interface
 - cost per logger (many sensors),
 - Delta-T's preferred approach as it is a best fit with our loggers & DeltaLINK software
- Either way:
 - battery life critical, innovative steps required for radio data protocol to maximise battery life
 - nothing on the market meets the needs of our customers:
 - low-cost, robust, reliable, easy to set-up and use (plug-n-play)
- Grower environments demanding:
 - Open fields
 - Vineyards
 - Greenhouses
- Looking forward:
 - benefitting from continuing radio technology improvements
 - GPRS, WiFi, proprietary radio solutions
 - network of sensors
 - internet of things





Radio Systems Research (2)

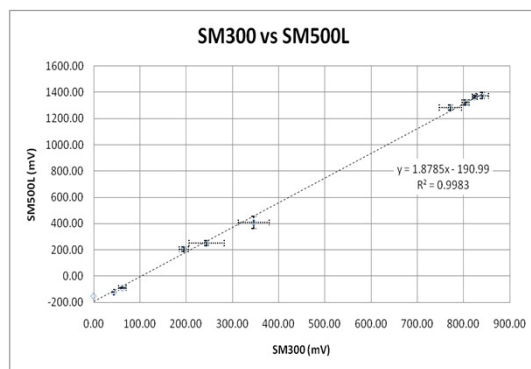


Spark Award application with Professor Soga at University of Cambridge



Soil Moisture Research

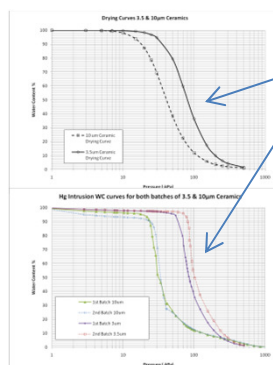
Soil Moisture Sensing



Dielectric Tensiometer Technology



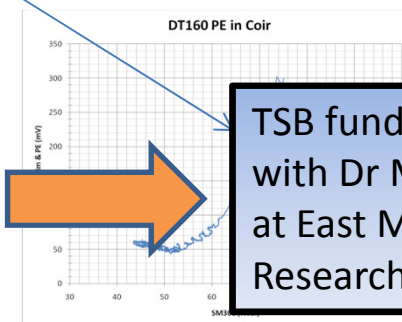
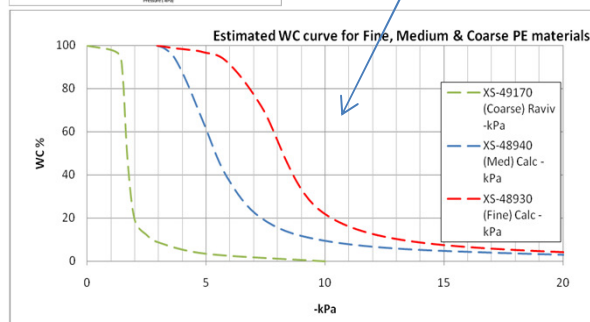
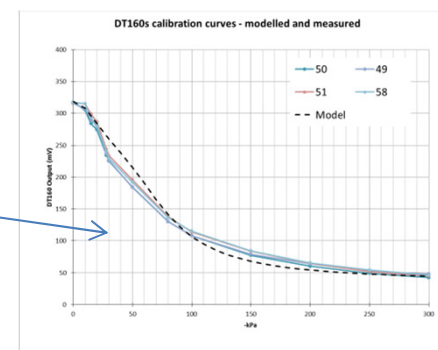
Also see FLOW-AID
Project from FP6,
Contract No. 036958



Ceramic characterisations

Modelled and
measured DT160
responses

Modelled & measured responses
using porous plastics

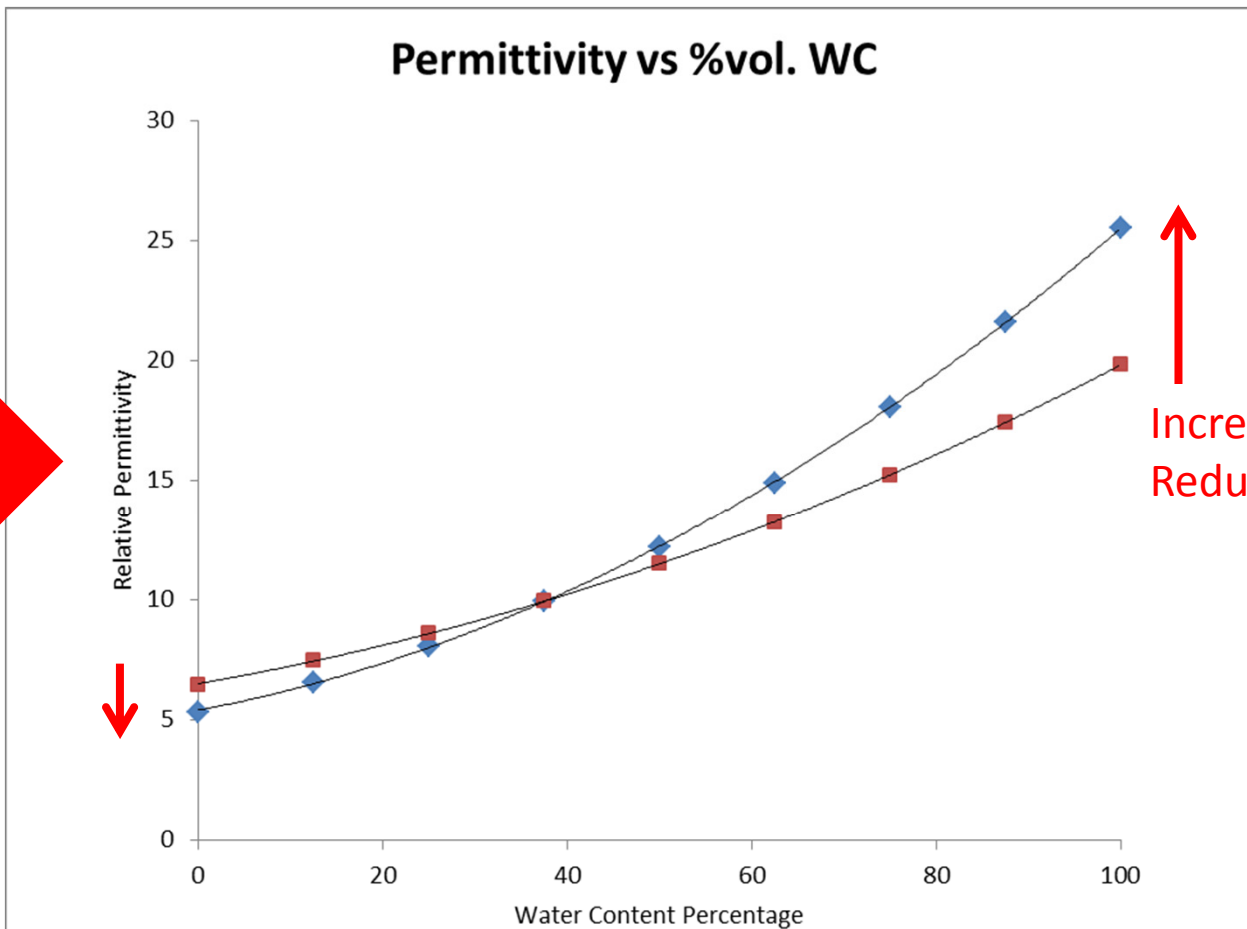


TSB funded project
with Dr Mark Else
at East Malling
Research

AT

Porosity: Permittivity vs %vol. WC

Soil moisture
sensors measure



Increasing porosity
Reducing density

Ceramic model to soil calibration methods

Collaboration
opportunity?



GP2 Data logger development

Following on from FlowAid EU project:

- More versatile and **easy to program** logger/controller
- Multiple irrigation control outputs for added zones and treatments
- Measurement of environmental parameters for more secure experimental hypotheses
- Open to a wide range of different applications
- GPRS/Internet connectivity



GP2 - Simple Programming

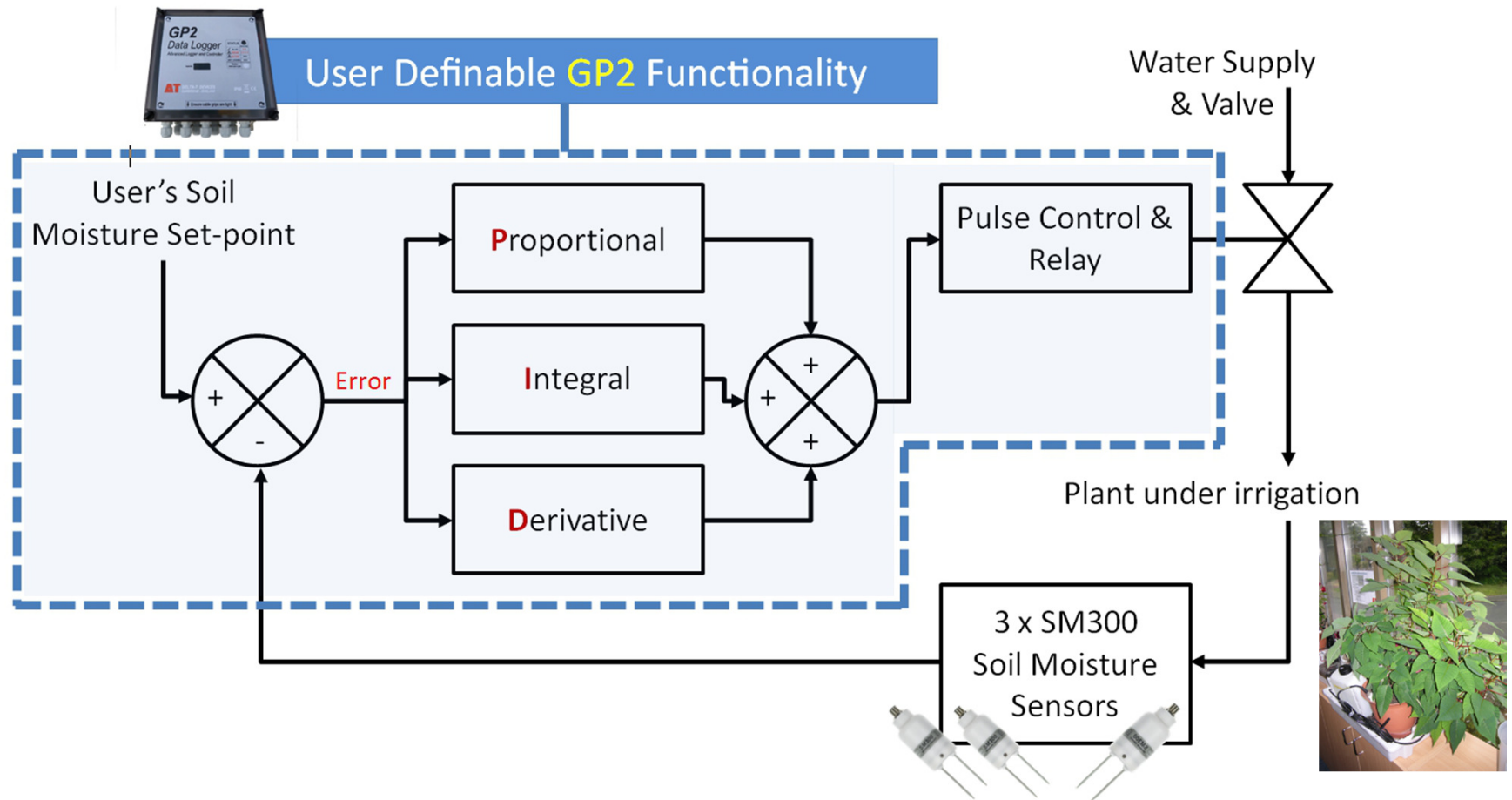
The screenshot displays the 'General Purpose Logger Program.pg6 - DeltaLINK Program' interface. The main window shows a list of sensors and a 'Recording' section. Overlaid on this is the 'DeltaLINK - Expression Editor (Script Mode)' window, which contains a toolbar with various operators and functions. Another window, 'Com8 - DeltaLINK Logger', is also overlaid, showing the 'Logger' and 'Program' tabs. The 'Logger' tab displays the serial number 'GP2-1-07', calibration date '15/01/2012', firmware '1.64', clock '25/09/2012 08:46:10', power '10.8 V', and error statistics. The 'Program' tab shows the name 'General Purpose Logger Program', status 'Logging', and various settings like 'CanIrrigate = 0 ~true..false'. The 'Dataset' tab shows the first and last records and the dataset full by (approx) '28/01/2014 16:46:45'. The 'Connection Details...' tab shows 'Com8: Any logger on COM8'.

Scripts (Advanced Feature):

Description: Scripts allow the user to define a custom script to be executed at a specified rate. This is intended for advanced users.

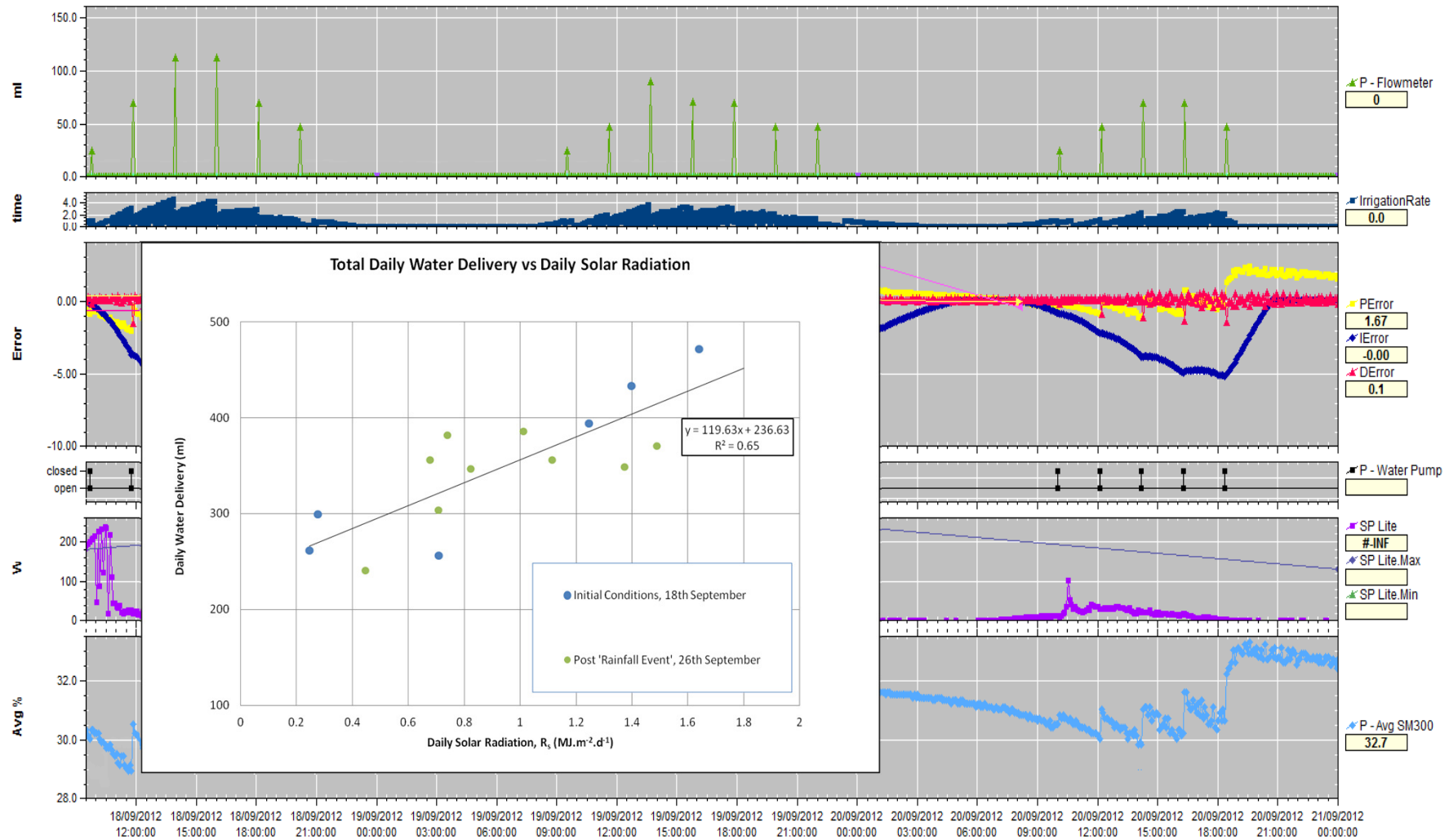


GP2 Application: PID controller



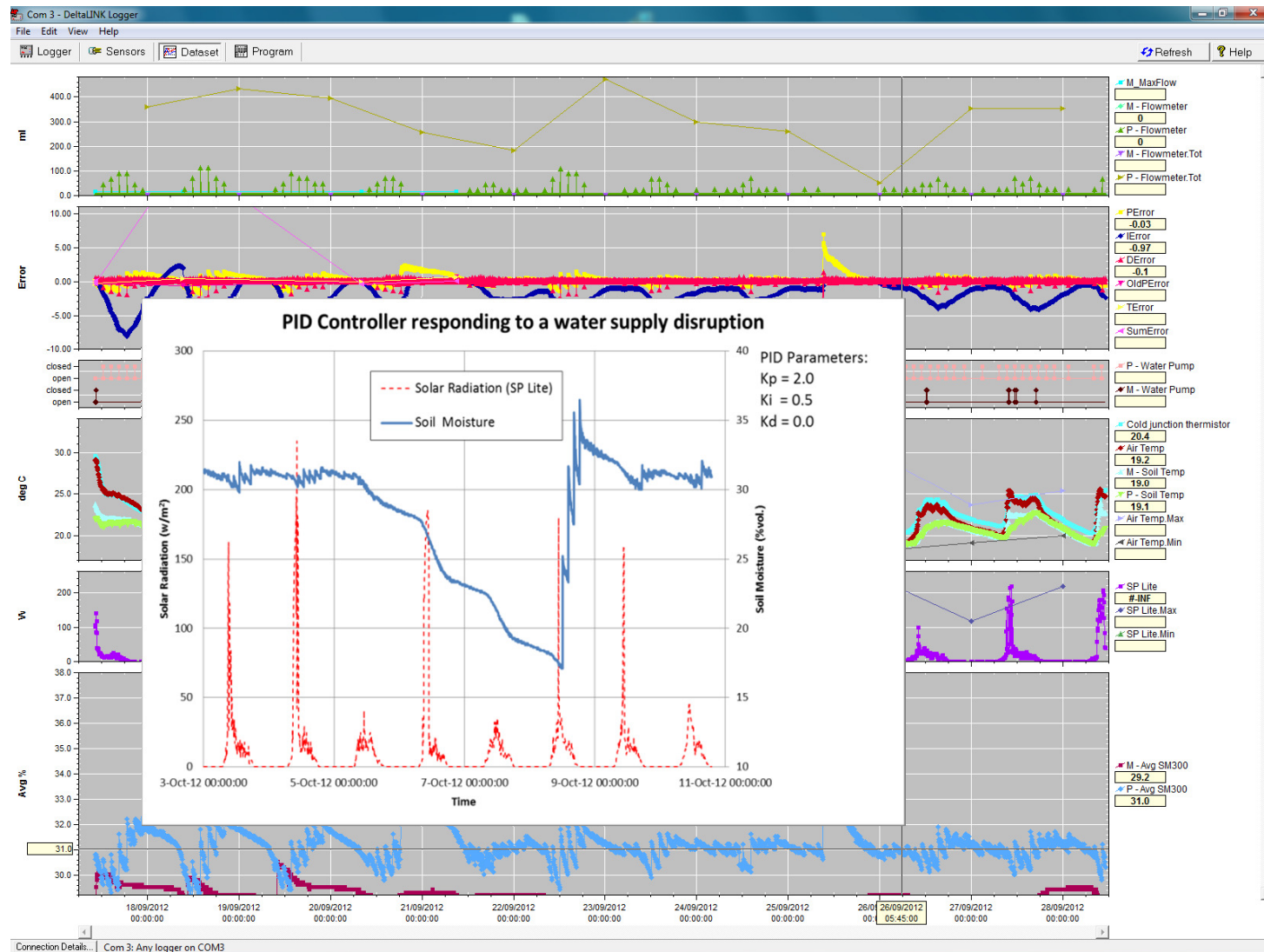


GP2 PID Dataset - a plant study



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GP2 PID Dataset - plant studies....





Summary

Delta-T has:

- growing markets addressing agricultural sustainability, food security and climate change
- 40 year track record of collaborative innovation and turning IP into market leading products
- other outputs including: academic research publications & IP creation
- academic partners currently include:
 - Rothamsted Research, OU, Manchester University & East Malling Research,
 - however, always looking to add to this list.
- healthy development funnel creating new products
- as a result of dielectric tensiometer work, Delta-T has attracted Technology Strategy Board funding from 'Water Security' competition to apply technology to agricultural and horticultural applications

Thank you for listening!