



27^o Congresso Brasileiro de
**ENGENHARIA SANITÁRIA
E AMBIENTAL**
Saneamento, Ambiente e Sociedade: Entre a gestão, a política e a tecnologia
15 a 19 de setembro de 2013 - Goiânia



Adaptive Sensors Group

17/09/2013

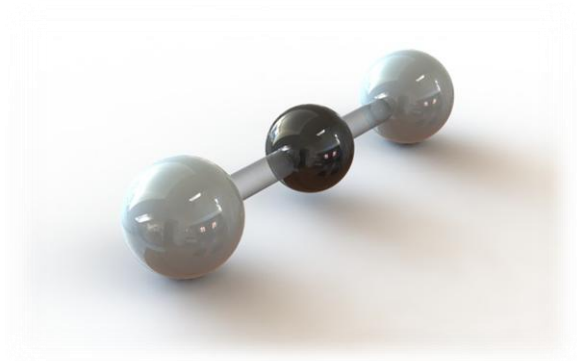


Environmental Gas Sensing

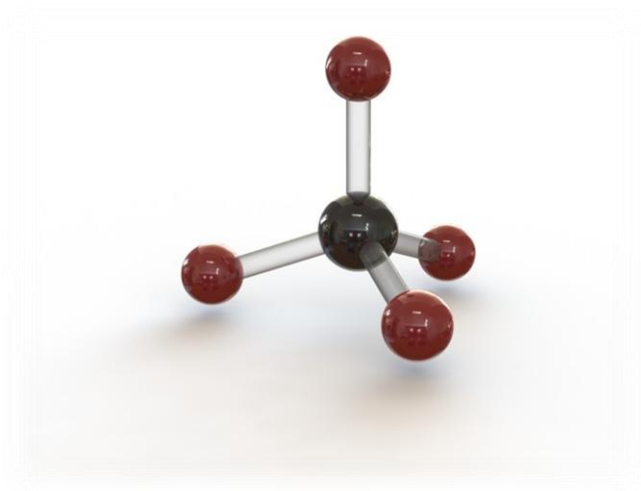
Adaptive Sensors Group (ASG)

Eoghan McNamara, MSc, BEng, MIEI

- Decomposing materials produce CO_2 and CH_4 . This is true for landfill sites and anaerobic lagoons in waste water treatment plants.
- These are produced alongside other gasses such as H_2S (hydrogen sulphide).
- EPA are particularly interested in CO_2 and CH_4 because CO_2 asphyxiates and CH_4 is highly flammable (5-15% v/v CH_4 /air).
- There is a need for a monitoring platform so gas levels stay in safe regions.



Background





Images from RTE News: <http://www.rte.ie/news/2011/0128/297061-kildare/> (Accessed 25/6/2013).
<http://www.rte.ie/news/2011/0131/297151-kildare/> (Accessed 25/6/2013).

- Development of autonomous sensor platform technology.
- Refinement of online interface and base station functionality.
- Continued commercialisation.
- System fabrication and development.

Specific Objectives

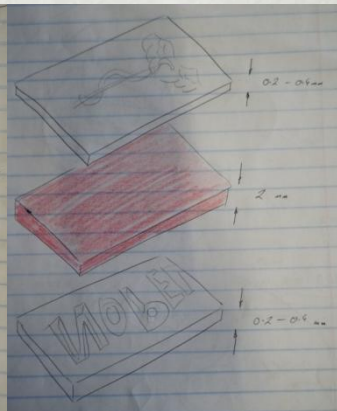
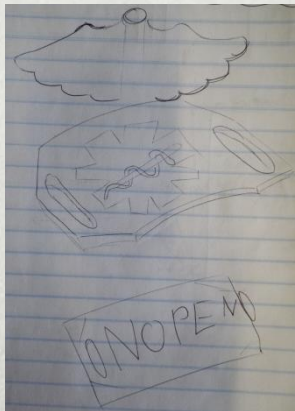
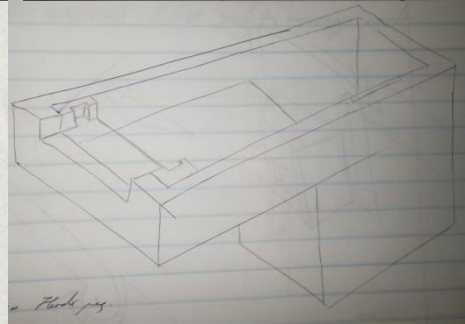
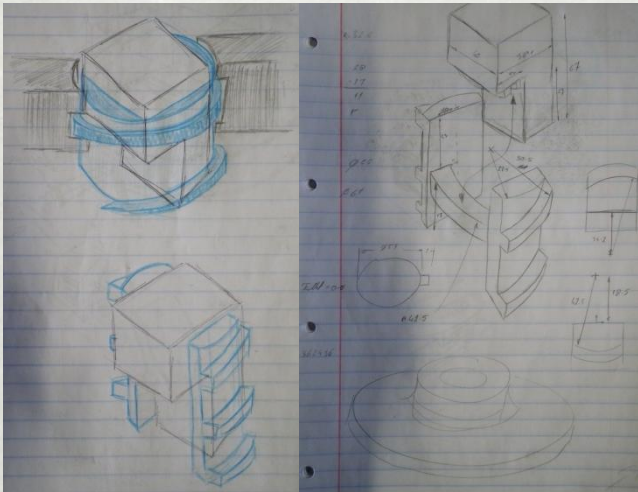
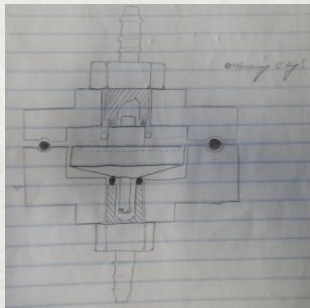
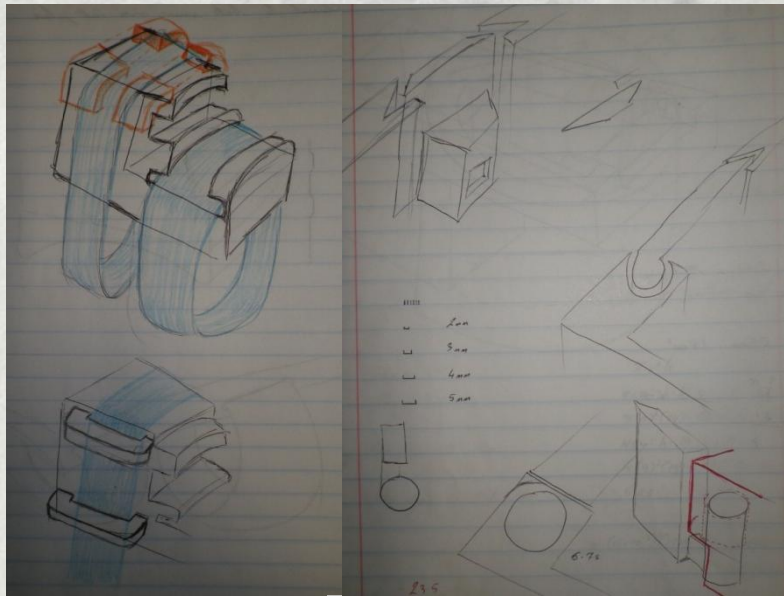
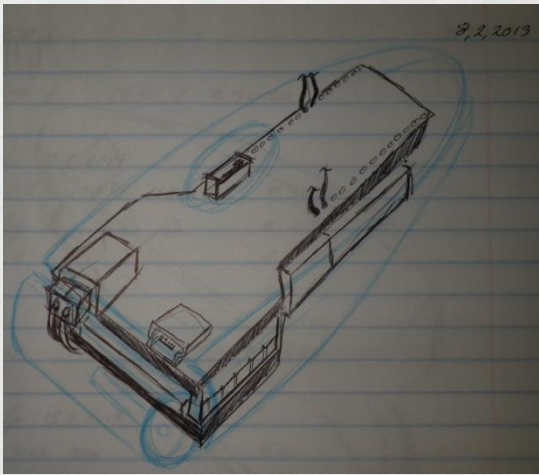


The creation of the
Generation 3 remote
autonomous gas
monitoring platform

- Start with a few bad sketches.

Design

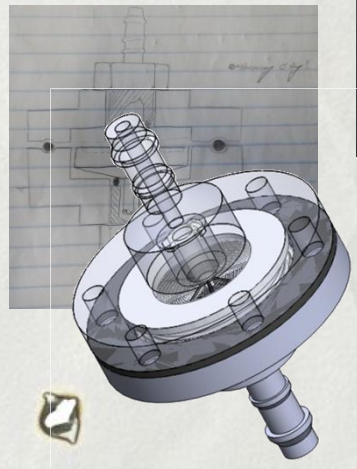
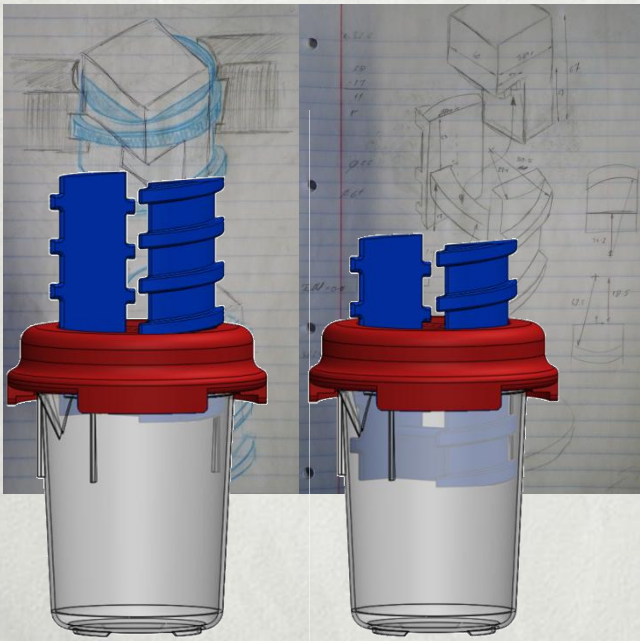
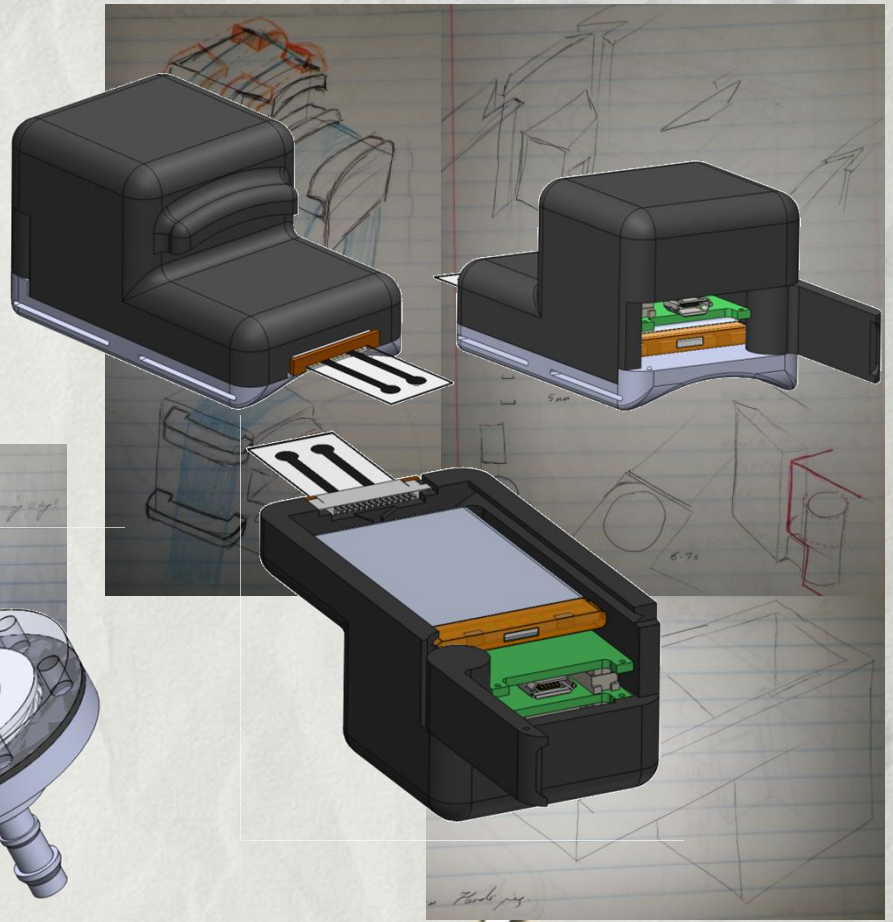
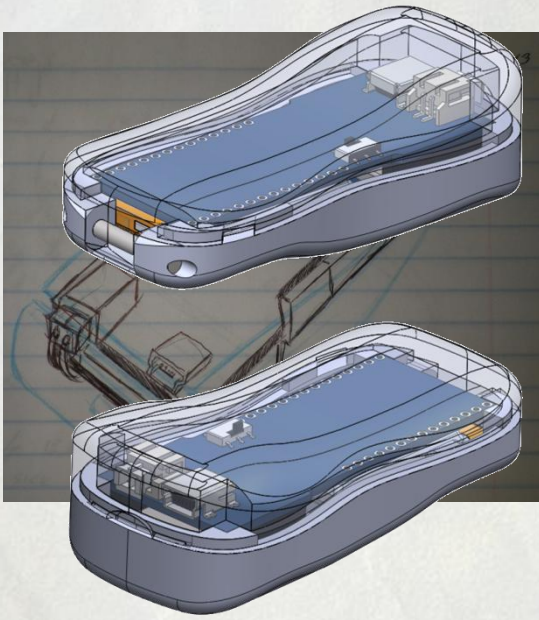
8.2.2013

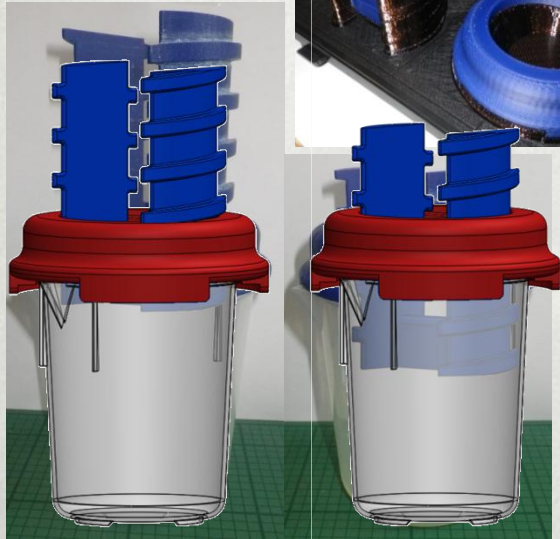
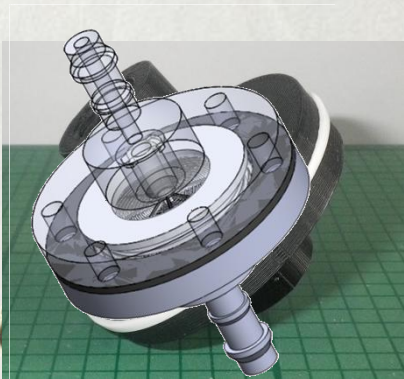
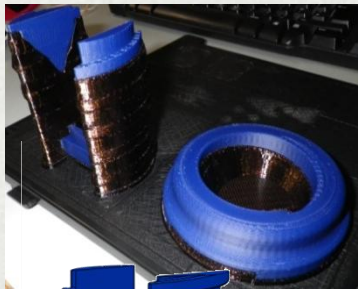
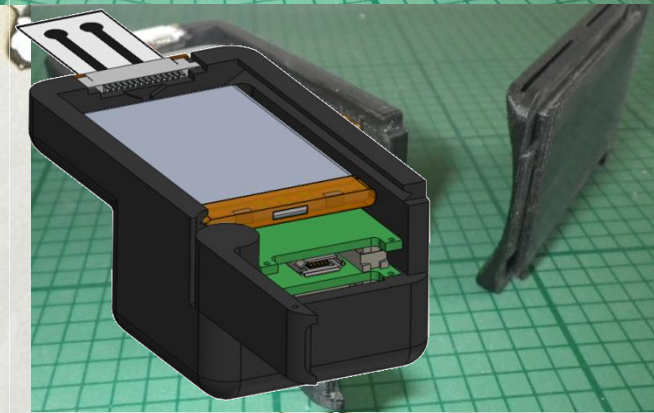
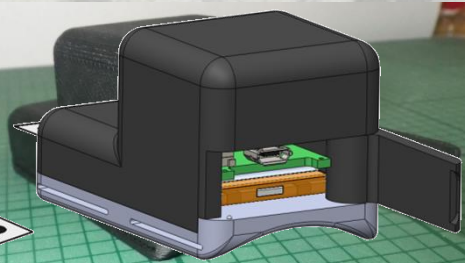
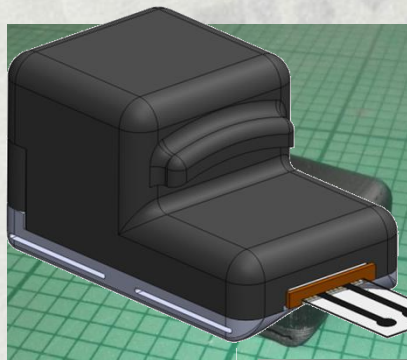
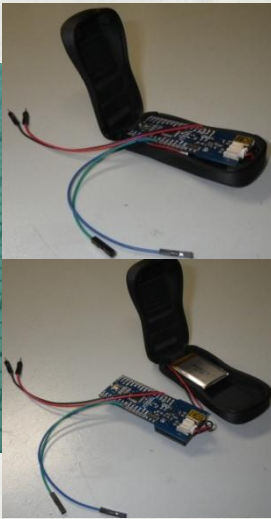
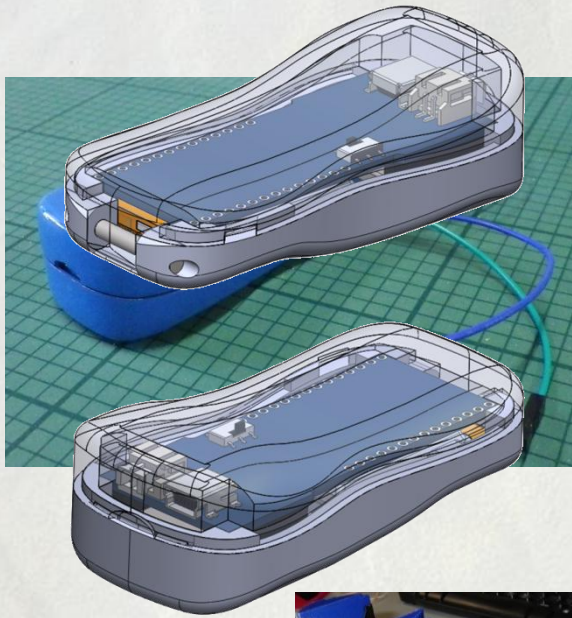


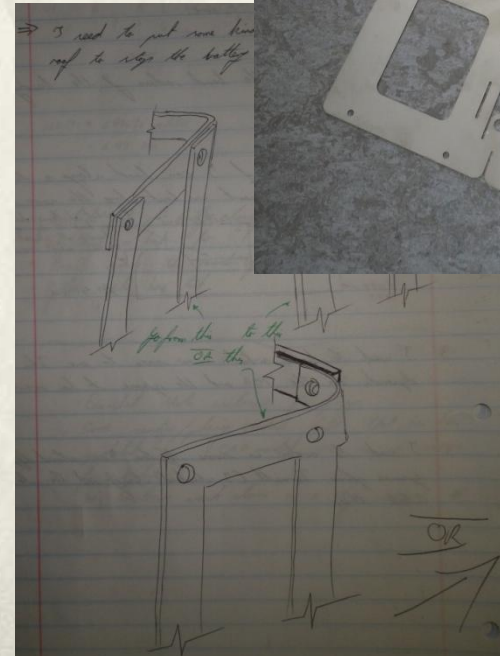
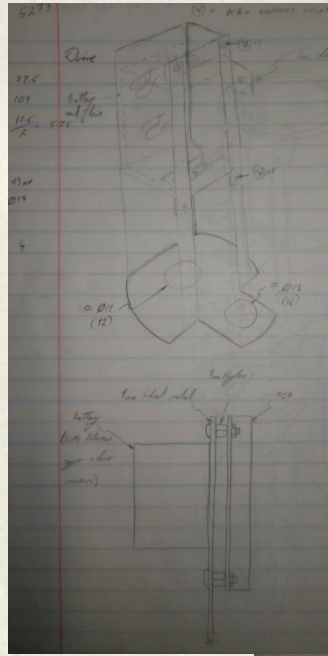
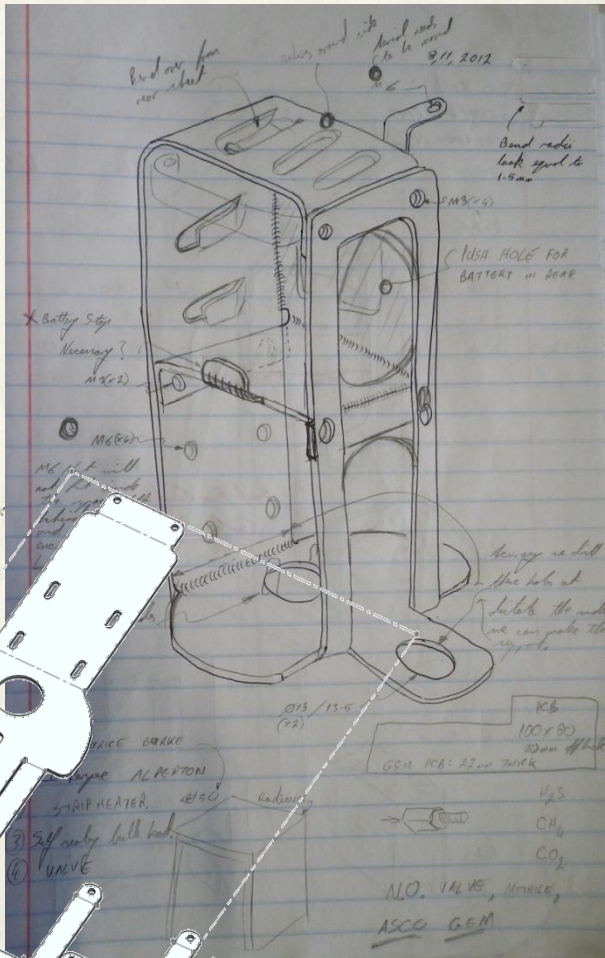
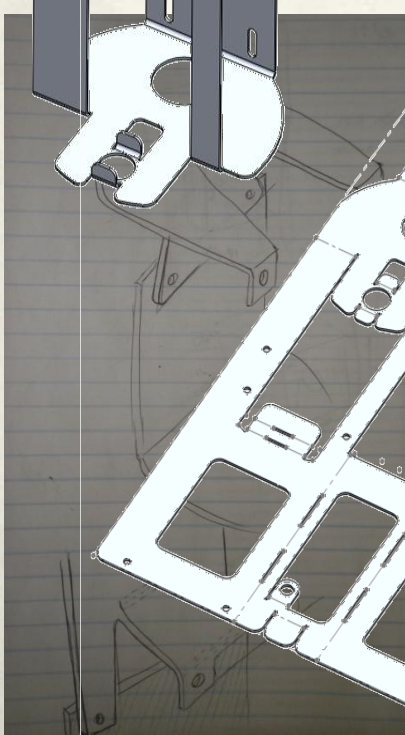
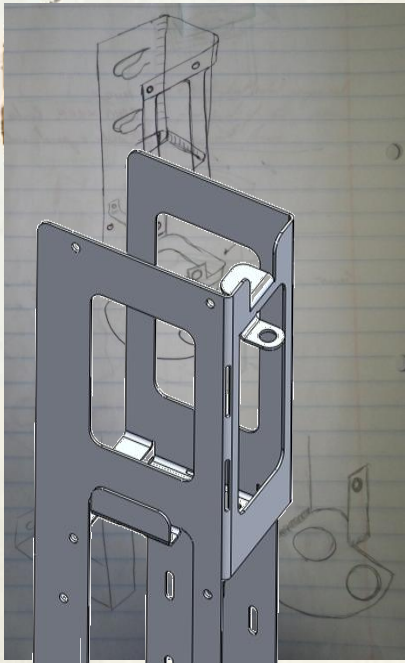
- CAD! (Computer Aided Design)
 - 2D drawings
 - 3D parts
 - 3D assemblies
 - Images – Renders – Animations

- Manufacture
 - Send DXF out.
 - Get parts back. Bend.
 - Turn on lathe.
 - 3D print!

Design

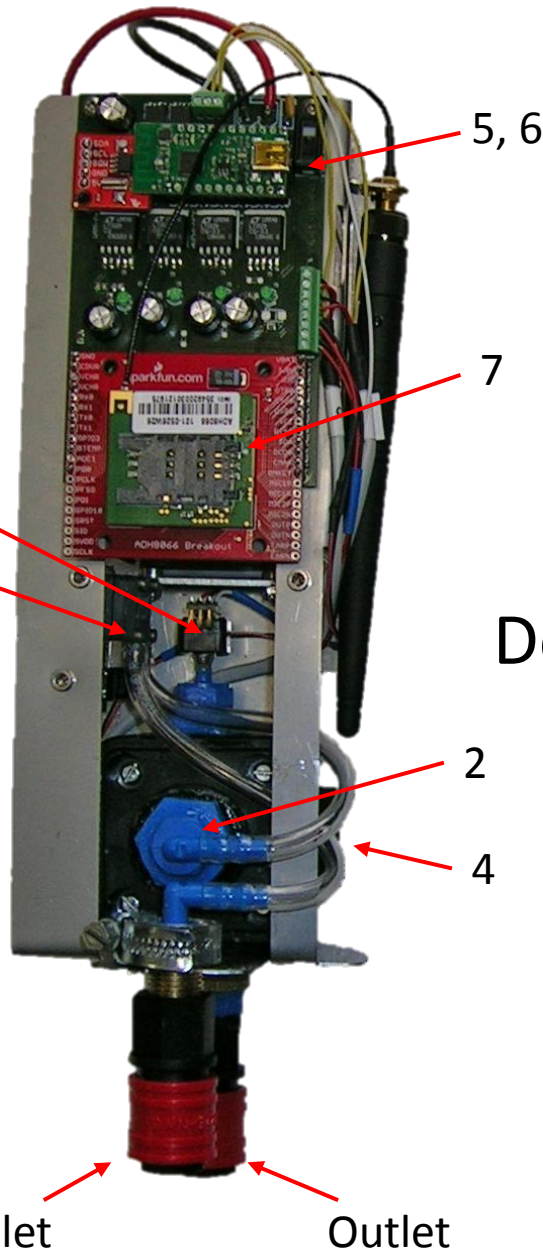






16, 11, 2012

1. Micro pump: draws gas into sample chamber.
2. Sample chamber: here 32 readings are taken for CO₂ and CH₄ and one reading for pressure.
3. Piezo electric pressure sensor: samples pressure every 2 hours.
4. IR gas sensors: samples CO₂ and CH₄ every 6 hours.



5. Data is stored on internal memory and transmitted once every 6 hours.
6. Memory is not wiped when power is lost.
7. Data sent via GSM to Basestation and stored in a data base.
8. Data base can be accessed via an online portal.

System Description

Inlet

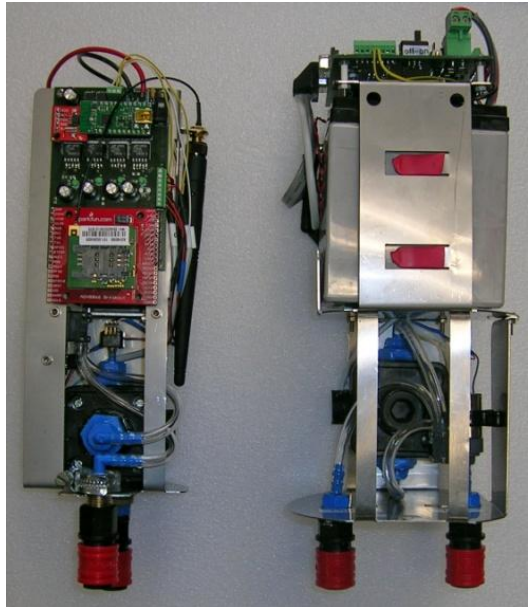
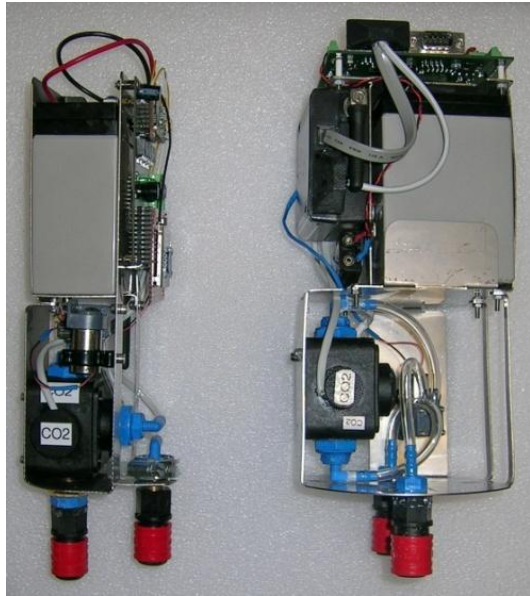
Outlet

- Autonomous system.
- Can be deployed to remote locations.
- Once deployed the system requires no further intervention for normal operation.



- Battery life can be as much as 3 months.
- When fitted with a PV cell battery life is extended indefinitely.
- IP68 casing protects the system from harsh wind and rain.

System Description



Gen 2 –V– Gen 3



Cost



Size



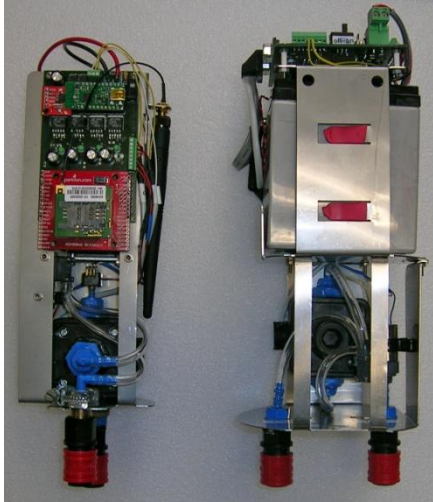
Function (CO₂, CH₄, Pressure)



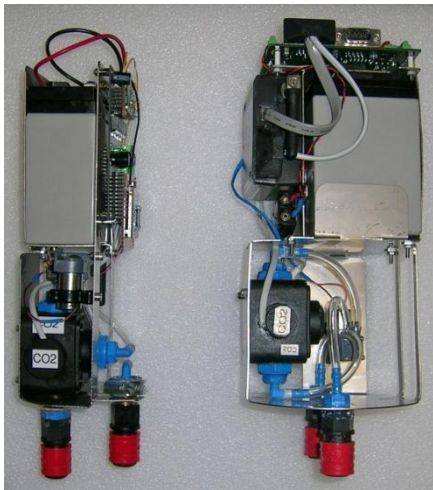
Environmental sealing



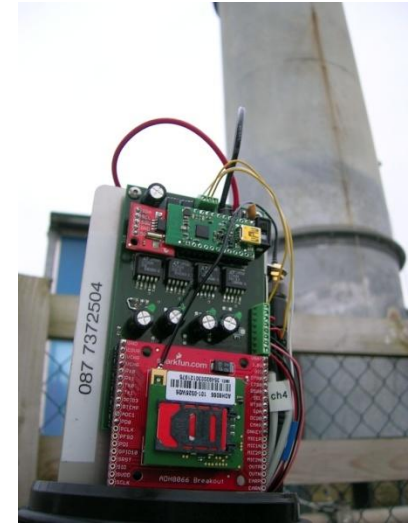
Commercial viability



GEN3 Vs **GEN2**



- ✓ 30% lower cost: Reduced labour
- ✓ Integrated gas and pressure sensing
- ✓ More compact
- ✓ Improved environmental sealing
- ✓ Future-proofed: updated circuitry + expanded functionality
- ✓ More user-friendly installation
- ✓ Commercial viability



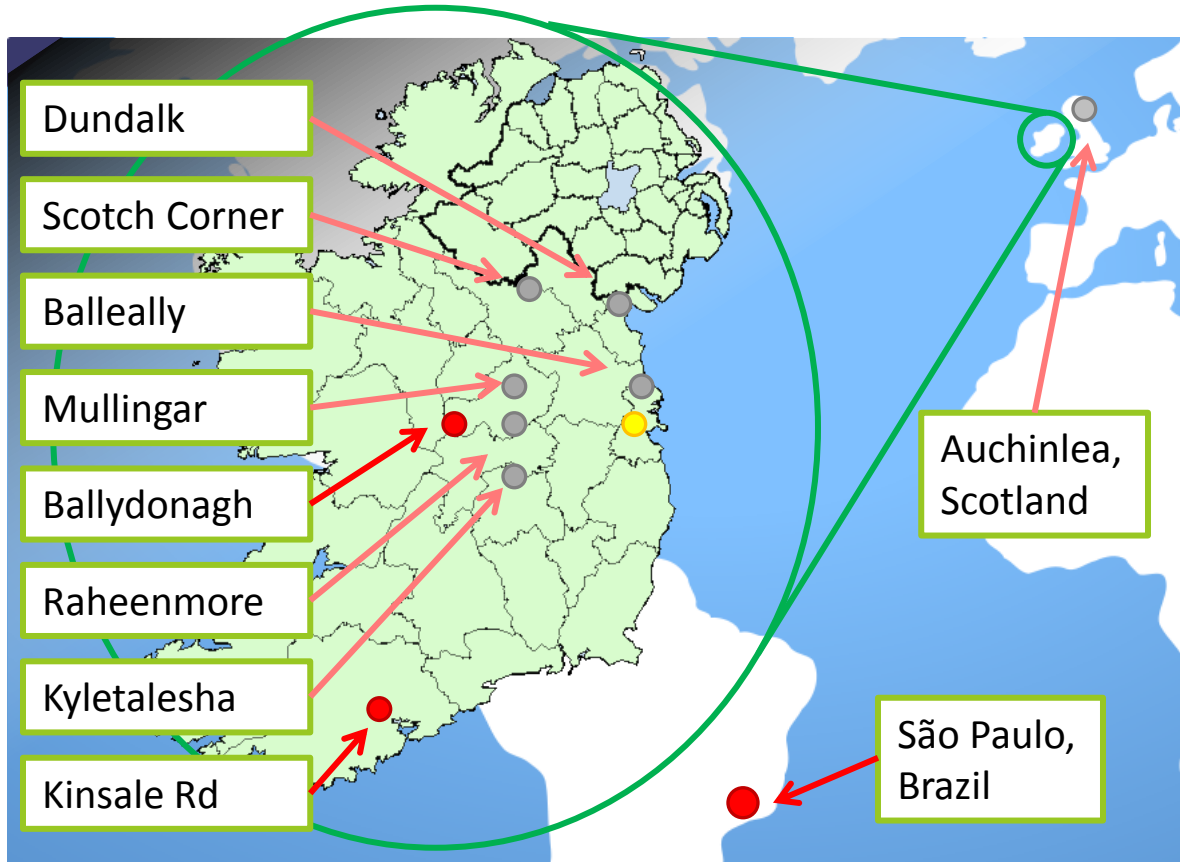
- Landfill extraction pipe.
- Anaerobic lagoon in waste water treatment plants.
- Urban air quality monitoring e.g. On buildings in urban centres, car parks etc.



Examples of use



Experience and Deployments



Gen2 and Gen3 system deployments to Ireland, Scotland and Brazil.

Deployments to Ireland and Scotland are landfill and peat bog sites.

Deployments to Brazil are to anaerobic lagoons.

Current Deployments

(And recent Deployments)



1 x Gen 3 module, Artur Nogueira,
São Paulo Brazil

1 x Gen 2 module, Pirassununga,
São Paulo Brazil

5 x Gen 3 modules, Athlone
Ireland

2 x Gen 3 modules, Cork
Ireland

2 x Gen 2 modules, Auchinlea
Scotland

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By Tom Patterson, March 2008





Swine effluent lagoon.

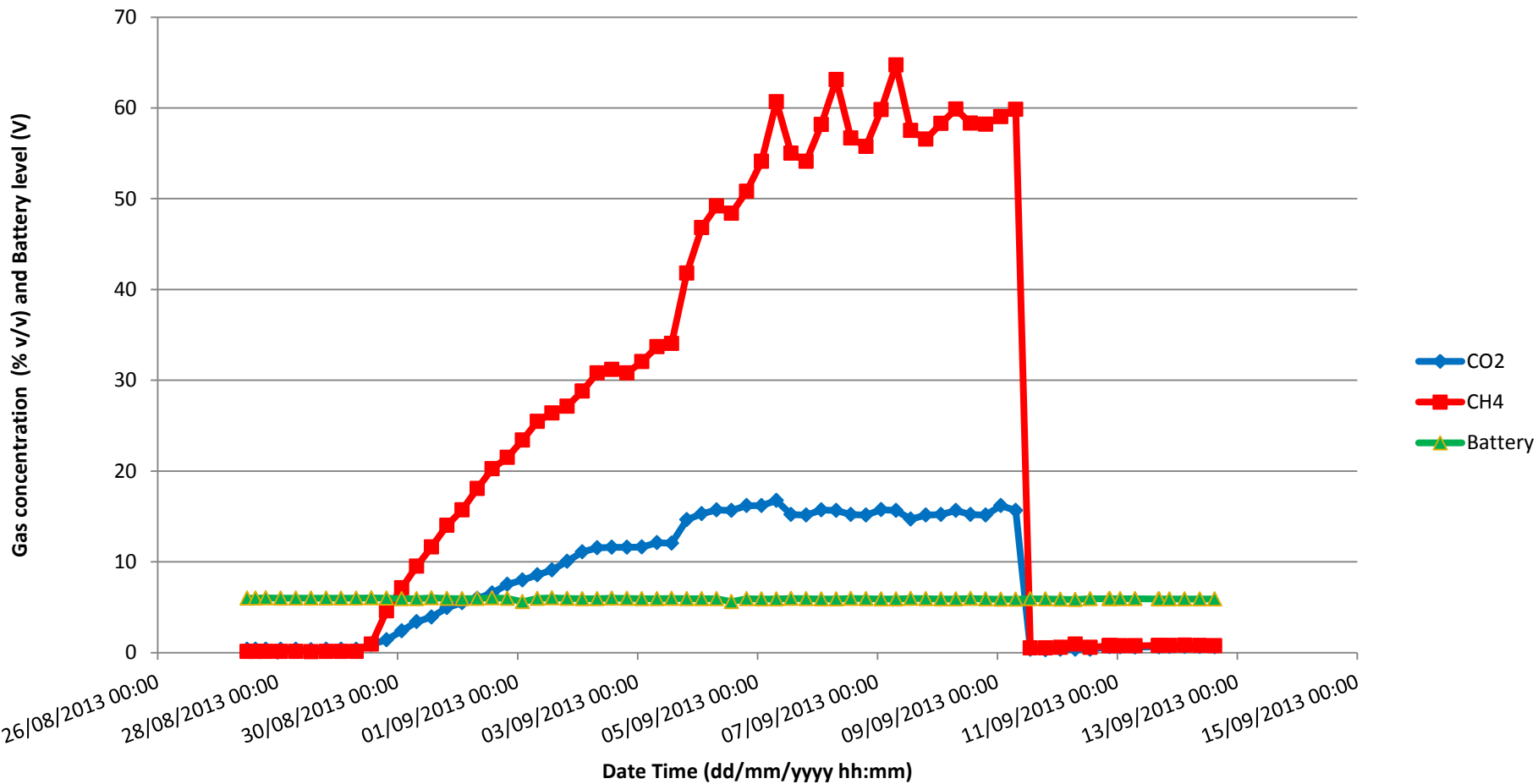
ZAZ department,
USP campus, SP,
Brazil.

“Test deployment of
Gen3 system”.

29/08/2013 –
09/09/2013



Brazil Deployment Data, Swine Effluent Lagoon



**Artur Nogueira – SP,
Brazil.**

**Gen3 deployment to
SEAN lagoon.**

09/09/2013



- Future work will see further deployments both in Ireland and Brazil, with the intention of multiple systems on one site to provide a sensor network.



- Further system development is currently underway to fit the Gen3 gas sensing platform with photovoltaic cells, increasing its battery life indefinitely.
- The Gen3 gas sensing platform may be fitted with alternate sensors to allow monitoring of other gasses, including SO_x and NO_x. Ambient air quality monitoring in urban areas and car parks are planned for the future.
- Further collaboration between USP and DCU on system deployments.

Future Work





Fondúireacht Eolaíochta Éireann
Science Foundation Ireland



Obrigado

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