

Convergence of Technology – Jet and Slot Aeration



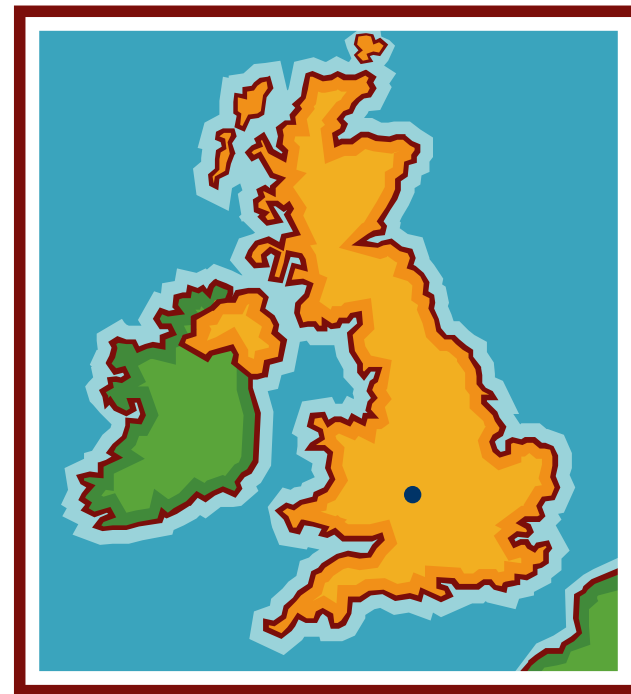
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Aquabio – Who we are

- Head office Worcester
- Employ 20 people
- 2 divisions
 - Process Design and Basic Engineering
 - Control panels and systems manufacturing
- Leading Industrial AMBR supplier in the UK
- Installed first wastewater treatment and re-use scheme to achieve ECA



Aquabio – Industrial Customers



Aquabio – Municipal Customers



YorkshireWater



DŴR CYMRU
WELSH WATER



SCOTTISH
WATER



STATES OF GUERNSEY



Capabilities in Wastewater Engineering & water recycling

- Process and Engineering Evaluation
 - Pilot plants
 - Lab trials
- Turnkey Design and Build
- Project Management
- Process Design and Basic Engineering
- Specialist Equipment Supply to Municipal and industrial markets
- Upgrade of Existing Facilities



Aquabio core technologies

- AMBR,
 - Membrane Bioreactors
- RO/NF/UF
 - Membrane Systems
- ASTRASEPARATOR & ASTRASAND
 - separation technology and biofiltration
- Jet Aeration and Mixing
- Dissolved Air Flotation



Jet and Slot Aeration Systems

- Low installation and capital costs
- No deterioration in O_2 transfer with time
- Excellent mixing Capabilities
- Can be designed for any tank geometries
 - Low Footprint
- Robust manifold design and tank internals
- Dry pump installation
 - Ease of maintenance



JETOX

WASTEWATER & SLUDGE JETOX AERATION AND MIXING TECHNOLOGY

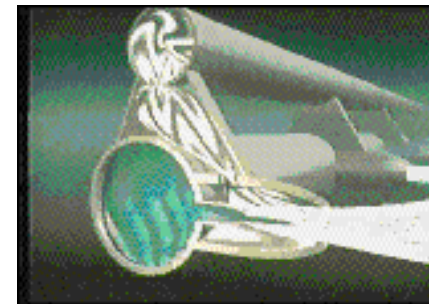
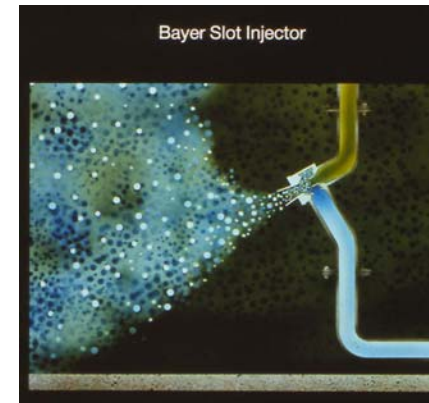
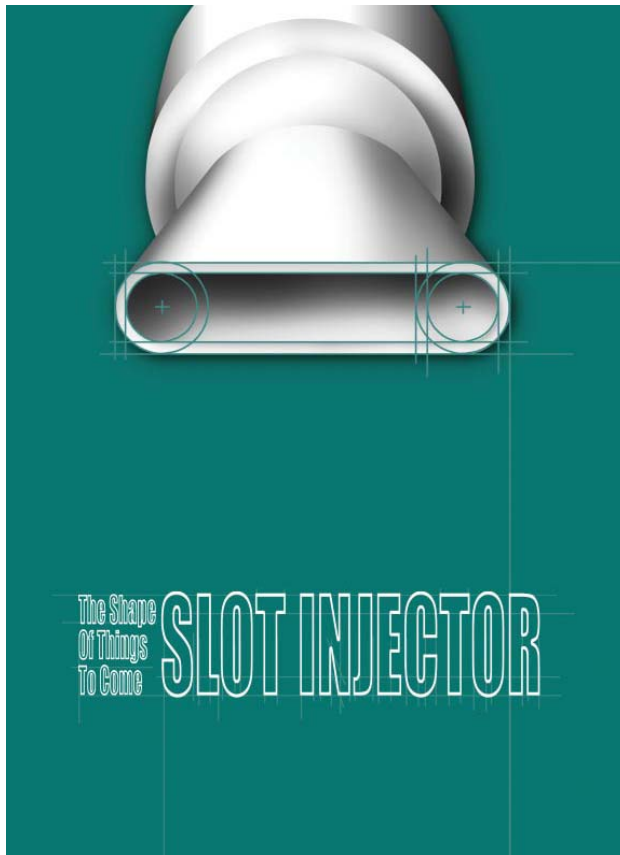


Key Benefits

- Cost effective
- Low maintenance
- Robust
- High MLSS performance
- Mixing independent of aeration
- Deep tank capability
- Worldwide references



Convergence of Technology – Jet and Slot



$K_L a$ Aquabio Partnership

- **Experience:** The industry leader in applying jet aeration and mixing technology on over 1000 projects over the past 20 years.
- **Technology:** Major advancements in system design, fabrication and performance.
- **Knowledge:** Industry leader in applying process, civil and mechanical engineering disciplines to our systems.
- **Service:** From the initial inquiry to successful operation, the team is committed to prompt and comprehensive service, exceeding customer expectations.



Development history

- **1980-1998:** jet aeration market develops worldwide.
- **1980-1998:** Bayer installs their technology at all of their production facilities worldwide, but has only limited success with marketing outside their core business



Development history

2002:

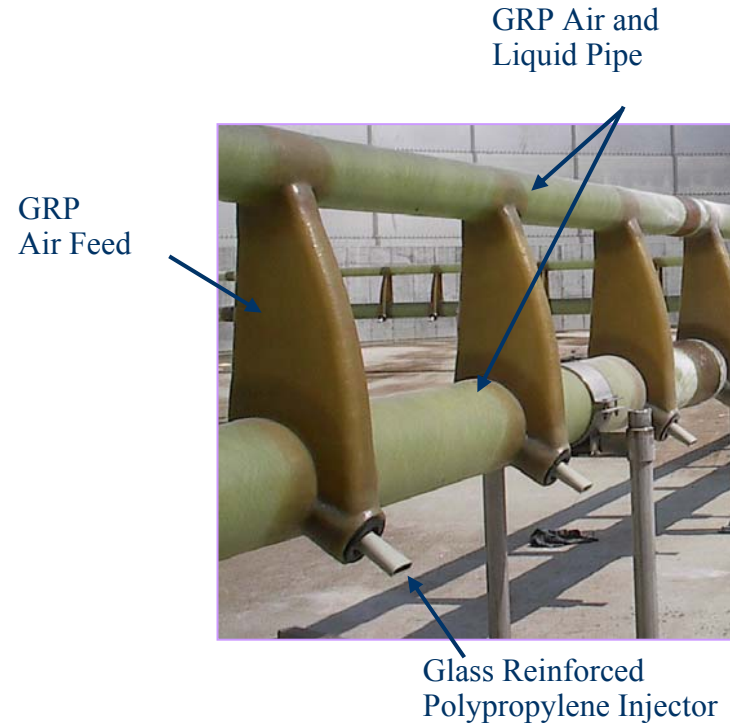
- Commencement of Slot Aerator Hydraulic Testing

2003:

- Oxygen Transfer Testing
- Technology Comparison

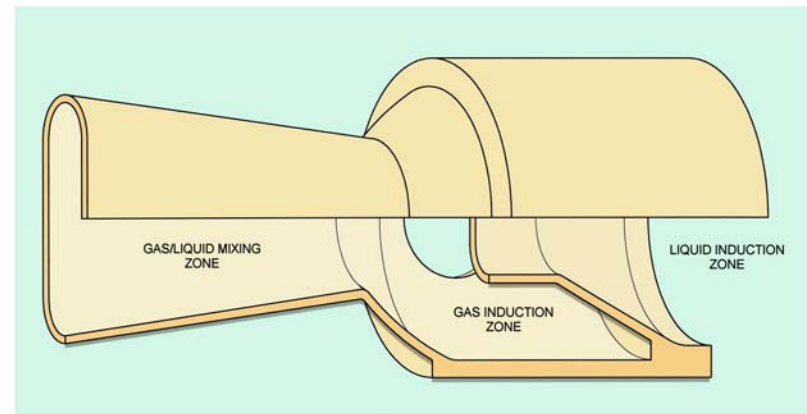
2004-2005:

- Refinement - Strategy
- Convergence-Manufacturing Technology
- Product Launch



Slot injector technology

- Both the inner and outer jets are slot shaped as opposed to circular.
- The aeration device has inner jet openings similar to a 1.0 in. circular jet aerator but with true ejector scale-up.
- True ejector scale-up translates to a device that retains more of the original features while addressing the need for larger jet openings.



SLOT INJECTOR

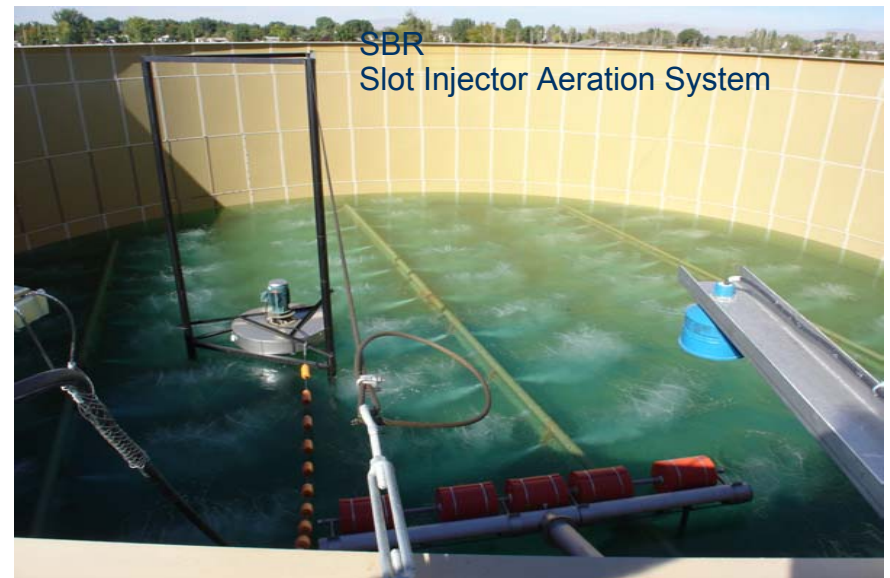
Slot injector technology

- Improved Energy Efficiency
 - 10 - 15% energy savings against 'conventional' Jets
- Lower Capital Cost
 - 15 - 20% Capital Cost savings against 'conventional' Jets (Smaller headers, reduced recirculation pump flow).
- Independent control of mixing and aeration
- Broad Application Base
- Low in tank downtime & maintenance



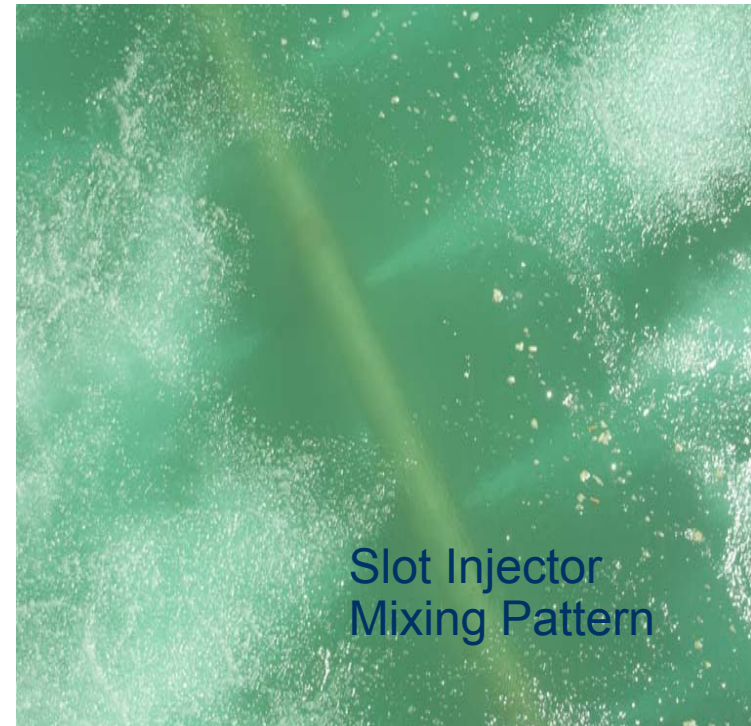
Improvements

- The slotted mixing chamber (outer jet) provides a greater shear surface for mass transfer compared to a circular jet of identical area.
- The transition in shape of the outer jet (from a circle to a slot), without the reduction in flow area allows the gas/liquid plume to retain more of its kinetic energy as it exits the device, resulting in more effective gas dissolution and mixing.



Observations

- The slot injector operates at a higher velocity and pressure compared to conventional jets.
- Air/liquid flow ratios are 2.0-2.5 times greater than conventional jets.
- Possible to optimise both air and liquid flow, resulting in peak aeration efficiency over a broad range of oxygen requirements – leading to development of OXYBOX
- Two phase flow optimization leads to improved process control and performance.



Further Observations

- The slot injector dissolves an equivalent volume of gas as conventional jet technology while utilizing 50-60% less liquid flow.
- Reductions in liquid recirculation offers *Significant Capital cost advantages* in the design of the liquid recirculation pumps and piping systems.
- There is the potential for a 10-20% improvement in aeration efficiency compared to 'conventional' jets.
- Advantages for: industrial laden wastewater, SBR batch processes and in high MLSS activated sludge (e.g. MBR's)

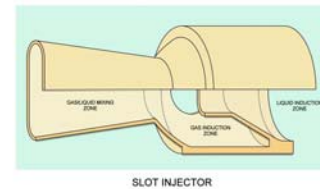


Bi-Directional Slot Injector Header

OXYBOX – Process and Energy Control

Improved Energy Efficiency & Reduces Operating Costs by:

- Optimising of pump and blower speed to dO_2 at the most efficiency air/liquid ratio
- Optimises pump mixing at low, or no, dO_2



Jet and Slot Aeration Systems - Summary

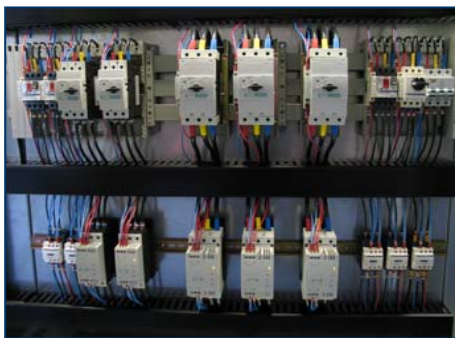
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AUTOMATION & CONTROL - CONTROL PANELS & SYSTEMS, MANUFACTURE, INSTALLATION AND SUPPORT

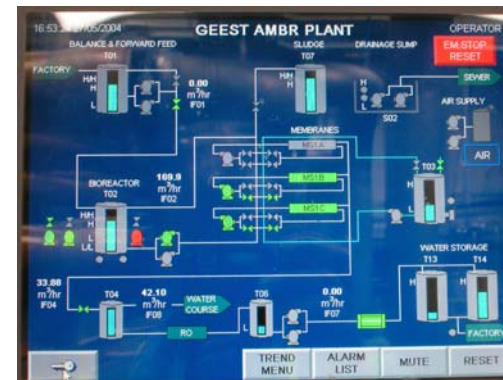
Capabilities

- Single door and modular MCC's
- Installation and site wiring
- Electro pneumatic automation



AUTOMATION & CONTROL, DATA CAPTURE

- PLC to SCADA Automated Solutions
- Operator Interface HMI or PC Based
- Ethernet, Profibus, ASI and Proprietary Networks
- GSM Modem, Internet Remote Access VNC



EUROPEAN MARKET LEADER – INDUSTRIAL WASTEWATER REUSE



Frost & Sullivan Research placed Aquabio Ltd as 2006 European Market Leader in Industrial Wastewater Recycling & Reuse, and winner of their Pioneering Market Strategy Award

