

New Learning Spaces at Liverpool – how was it for us?

Presented today by Peter Goodhew FREng

The Department of Engineering Vision...

To be an acknowledged centre for international-level research in a 21st Century engineering environment and an innovative education centre whose programmes will attract students from all over the world

**An excellent learning environment
for the engineers of tomorrow**



What we have achieved 2002-2009

- Unified Department (Aerospace, Mechanical, Civil, Materials, Manufacturing)
- Eight research groups (Construction & Infrastructure, Dynamics & Control, Flight, Fluids, Functional Materials, Manufacturing & Lasers, Maritime Environmental & Water Systems, Structural Mechanics & Materials)
- Revision of all teaching programmes under the brand “The Liverpool Engineer”
- New and refurbished buildings to house everything
- An art show



How did we get here?

- **Strategic plan in 2002**
- **Joined CDIO in 2004**
- **Visited other Universities (more below)**
- **Decided to change teaching methodologies, branded as “The Liverpool Engineer”**
- **Given funds for new / refurbished buildings (£34M)**
- **Appointed a LE project manager**
- **Launched LE degrees in Oct 08**
- **About half-way through implementation of plan**
- **Feedback from LE graduates in 2012-2014!**



The importance of being active

**Engineering [education] is not a “spectator sport”;
one has to be ‘engaged’ both mentally and
physically, to learn**

Active Learning is central to the LE programmes



The Brief

- Flexible
- Nothing bolted to the floor
- Handle 250 students at a time, in teams of 3 to 6
- Capable of coping with C, D, I and O
- Access for big, heavy things
- Storage needed
- Some things need to be behind locked doors
- Iconic building



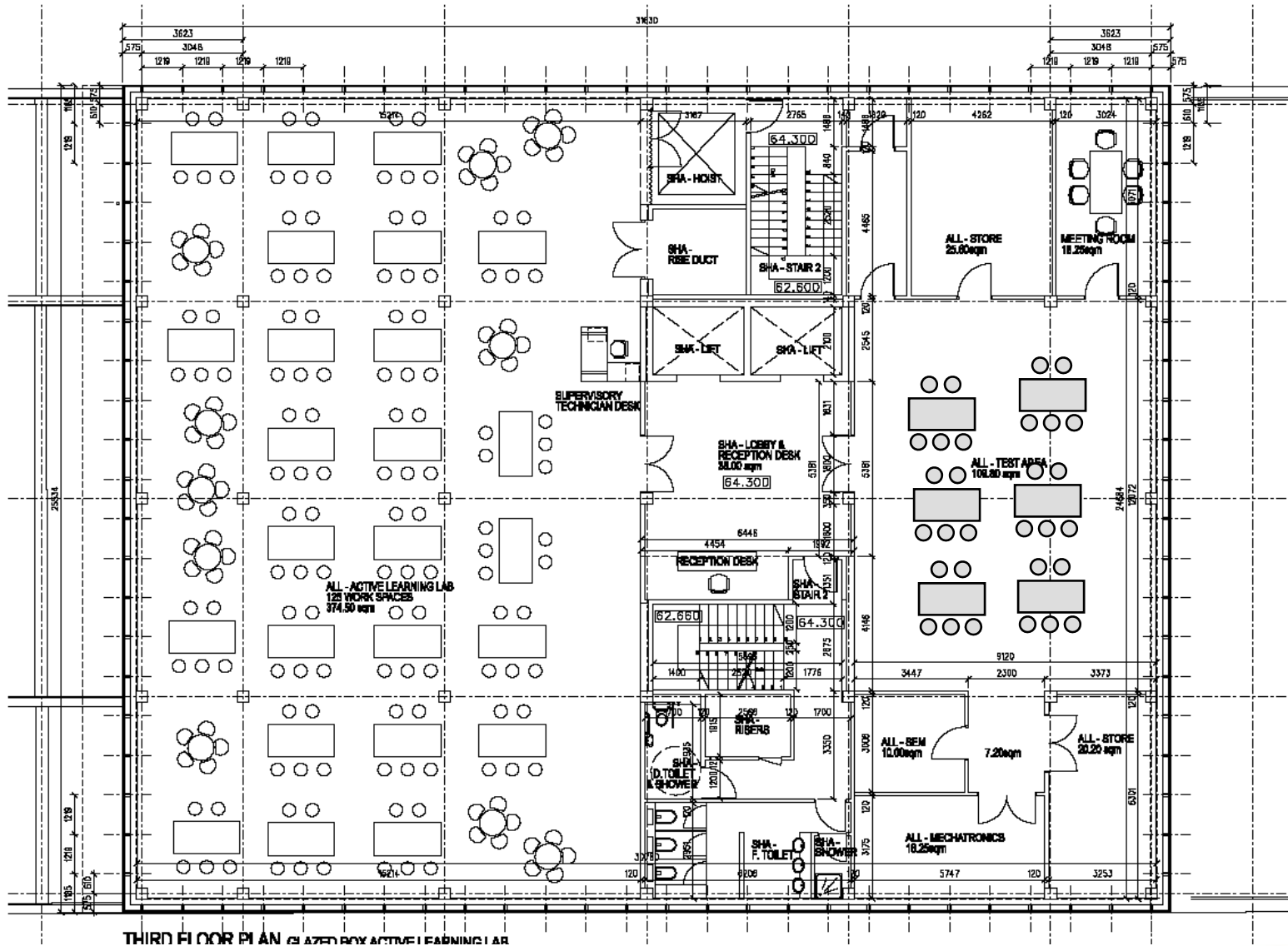
What did we get?

- Two very flexible spaces, with capacity for 125 each
- Largely open spaces with a few pillars
- Hoist access for large items
- Supporting spaces for ancillary equipment and functions
- Custom-designed benches for team working, with
 - Integral seating and storage
 - Flat top – link to make a stage
 - Movable by one person

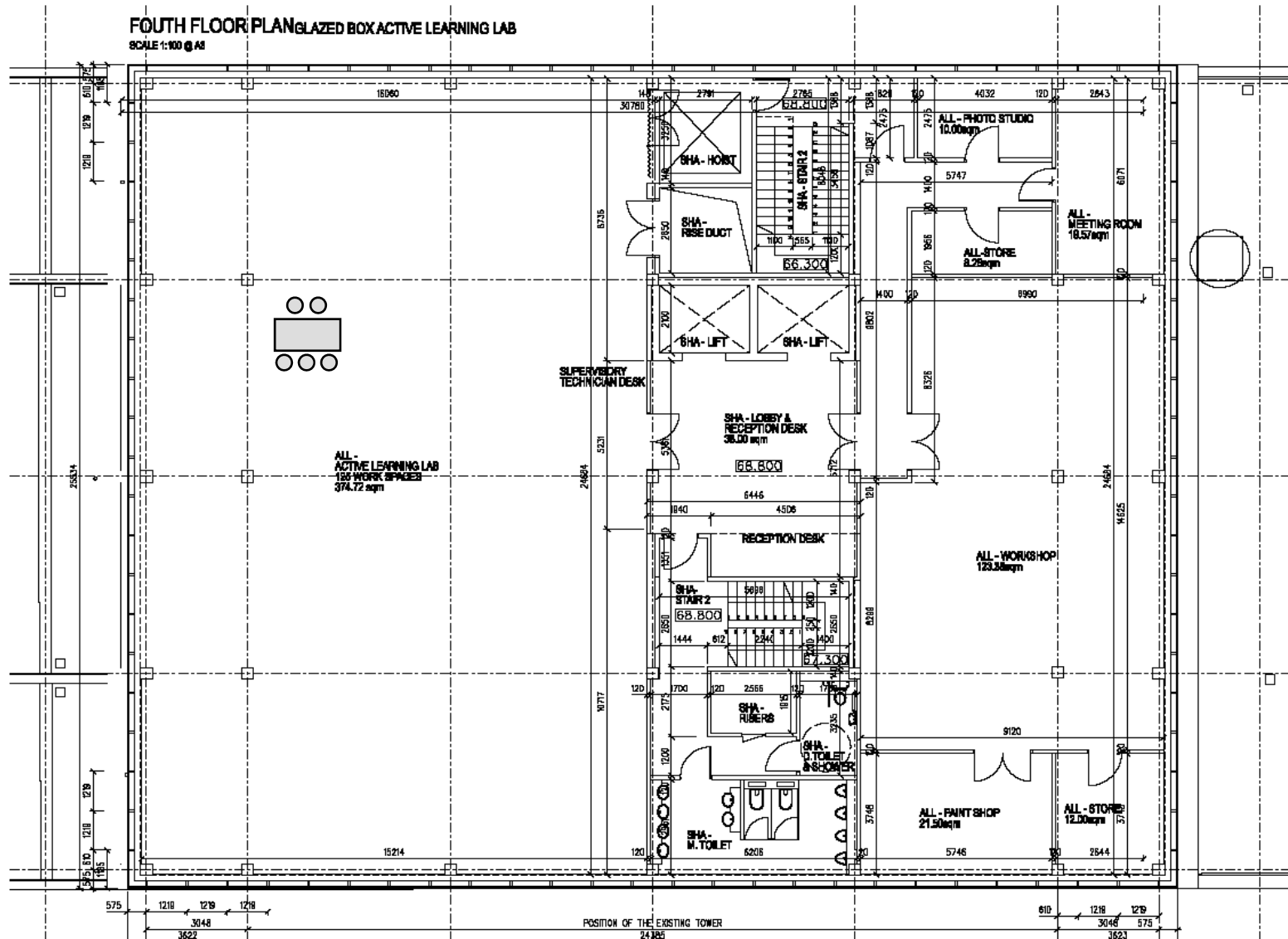




ALL: Lower (3rd) floor layout



ALL floor plans; upper (4th) floor







ALL: the spaces

- Upper ALL – 27 benches, 125 students, 5m headroom
- Lower ALL – 27 benches, 125 students, 3m headroom
- Student workshop – RP, exemplar machines
- Testing/assembly area – testing, remote SEM, laser cutter, space for assembly
- Two seminar rooms – 6-8 students each, one with AV, other with interactive whiteboard
- Robotics Lab – 2 robots, picker, conveyor (Carl Hauser)
- Wifi
- Eight projectors plus audio
- Photographic equipment
- CNC lab (downstairs)



Enough for now

- I can tell you what we have actually done, later



Characteristics we are trying to encourage

- Confidence
- Team work
- Creativity and innovation
- Experimentation, initiative
- Failure
- A reasonable attitude to risk and safety
- Judgement
- Ownership
- Enquiry
- Awe



ALL: the range of activities

- Ice-breaker
- Two Week Creations (TWCs)
- Lab classes
- Project work
- Team meetings
- Resource “room”
- Presentation practice
- Robotics
- Competitive, voluntary or optional, projects (Formula student etc)
- Data access and an Engineering “library” or “observatory”
- Engineering club meetings
- Degree shows
- Reachout activity, e.g. summer schools, school clubs
- UCAS days
- Open days



Meccano bridge





Storage



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Some issues

- Student ownership
- Safety
- Late working
- Academic staff imagination (lack of)
- Technical staff enthusiasm (lots of)
- Displays (making it look like Engineering)



Some impressions

- Busy
- Cluttered
- Groups/teams
- Old stuff
- Small spaces
- Flexible enough?



ALL: how to maintain it

- Money
- Staff – permanent and volunteer
- Students, as users and monitors
- Audio/video displays
- Wall displays
- Artefacts/ products



ALL: year-round use

- Web-access timetable and booking
- 8.00 to 23.00 opening



Activities elsewhere

London Metropolitan University (Emirates Stadium)

Chalmers University, Gothenburg (CDIO partner)

Queen's University, Kingston, Ontario (CDIO partner)

Colorado School of Mines, Boulder, Co (CDIO partner)

Queen's University, Belfast (CDIO partner)

Materials and Design Exhibition (IoM3)



London Metropolitan University

- Science labs





TO ALL STUDENTS

PLEASE TAKE A PAIR OF HEADPHONES AND BRING THEM WITH YOU EVERY TIME YOU COME TO THE LABORATORY. DO NOT RETURN THEM TO THE SIDES.

ALWAYS RETURN THE RECEIVES PAGES TO THE CHARGING UNIT.

STUDENTS MUST

BRING THEIR

OWN HEADSETS

TO

LABORATORY

CLASSES!

TO ALL STUDENTS
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Chalmers, Gothenburg (CDIO)





19. 11



hager

METAL

FG

EVA

HOODSTOP

1	2	3
4	5	6
7	8	9
0	⏪	⏩

1	2	3
4	5	6
7	8	9
0	⏪	⏩

1	2	3
4	5	6
7	8	9
0	⏪	⏩



Queens, Kingston Ontario (CDIO)













Colorado School of Mines (CDIO)







I hear...I forget.

I see...I remember.

I do...

I understand

I hear ... I forget

I see ... I remember

I do ... I understand





PETE MAXWELL
ELECTRICAL

LEE MARES
CONCRETE
FINISHING

CKEE
ICATION

PAUL MCCORISON
CIVIL ENGINEERING

JEFF MARCILLIAT
OVERHEAD GRILLS

DOUG McCLAIN
SPRAY ACOUSTICAL

KYLE N. MANGNALL
PAINTING

Library of artefacts, components materials and engineering exemplars

MADE in London





Small informational card with text, likely describing the mallet.



ProE Intensive Week

Overview

- Individual computer based project
- To complete an industry standard CAD training course



- Delivery
 - Yr 1, 200 students
 - All non-Civil Programmes
 - 5 x 8hr sessions
 - Introduced AY2005-06



Ice-Breaker

Overview

- Team based practical project
- To build & test a cardboard model truss bridge



- Delivery
 - Yr 1, 250 students
 - All Programmes
 - 4 x 3hr practical sessions
 - Introduced AY2005-06



Two Week Creation

Overview

- Team based practical project
- To design, build & test either a cardboard model **bridge**, remotely controlled **aeroplane**, or water powered **rocket**



Delivery

- Yr 1, 250 students
- All Programmes
- 10 days, full-time
- Introduced AY2005-06



Formula Student Capstone

- Overview
 - Group project (25+)
 - To design, build, cost, test and race a single seat racing car
 - Part of international competition
- Learning Outcomes
 - Project management
 - Teamwork
 - Manufacturing
 - Design
 - Costing
 - Race Preparation
 - Marketing & Fundraising
 - Workshop practice
 - Supplier / sub-con liaison



- Delivery
 - Up to 30 students, Yr3 and Yr4, Significant non-timetabled effort
- Introduced AY2005-06

Costs >£10k per year



Alternative Capstone Projects

- Aerospace – to DBT:
 - Small scale heavy lift aircraft
 - Small scale quad-rotor aircraft
 - Full scale light aircraft
- Mechanical – to DBT:
 - Human powered submarine
 - Solar powered vehicle
- Civil
 - To replicate elements of an ongoing, 'live' construction project (design, costing, planning, management etc)
 - To visit the site and engage with professional engineers
 - To be assessed by the engineers working on the project

All cost ~£5k



Queen's Belfast (CDIO)



The 4 Dimensions

- **Deep technical knowledge and skills**
- Appreciation of life cycle processes
 - Systems engineering
- Professionalism
 - Team-work, leadership, ethics, economic viability, societal and environmental constraints, sustainability....
- Commitment to life-long learning



Active Learning might include:

- Problem-based learning
 - Project and field work
 - Team and group work
 - Interaction – in lectures and laboratories
 - Open-ended problems
 - Design-build-test-operate
 - Ownership of learning
 - Asking questions
 - Competition
 - Simulations
- Individuals are already doing all of these things – but most modules are not yet active



Introducing ALEs

