

EPSRC Industrial Engagement Workshop

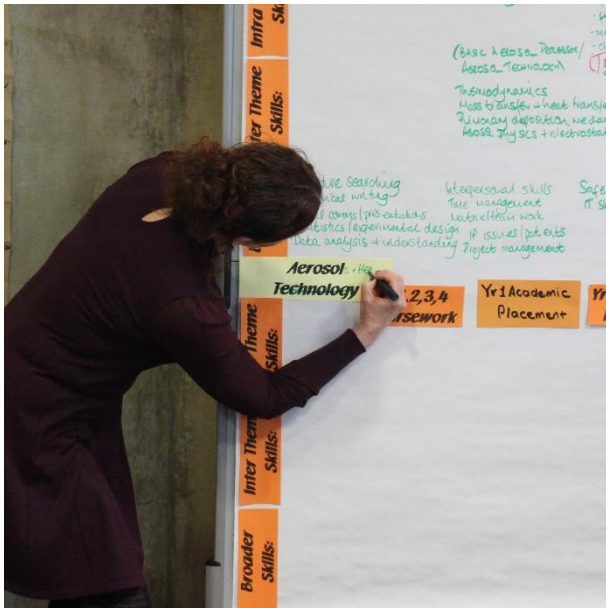
8th January 2018



Facilitated by Rob Walsh
Recorded by Matthew Allman
Documented by Melanie Hancock

project management programme management
strategy execution facilitation product selection
vendor selection facilitation change management
project management programme management
strategy execution product selection vendor se

A Snapshot of the Day



EPSRC
Engineering and Physical Sciences
Research Council

University of
Hertfordshire **U****H**



Agenda

- 09:30 am Arrival (refreshments will be available, and throughout the day)
- 10:00 am Session 1: Introduction and Overview
- 11:00 am Breakout Session 1: Industrial Training and Research Needs
- 11:25 am Coffee Break
- 11:45 am Session 2: Prioritisation of Training and Research
- 12:15 am Lunch
- 12:45 pm Breakout Session 2: The PhD student Journey
- 2:00 pm Coffee Break
- 2:15 pm Session 3: Meeting the Government's Industrial Strategy
- 3:15 pm Wrap-up
- 3:30 pm Departure from Hatfield

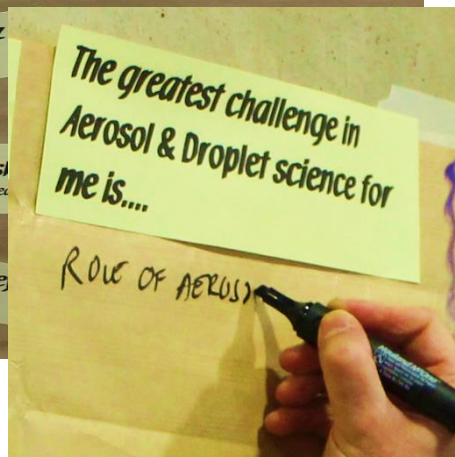
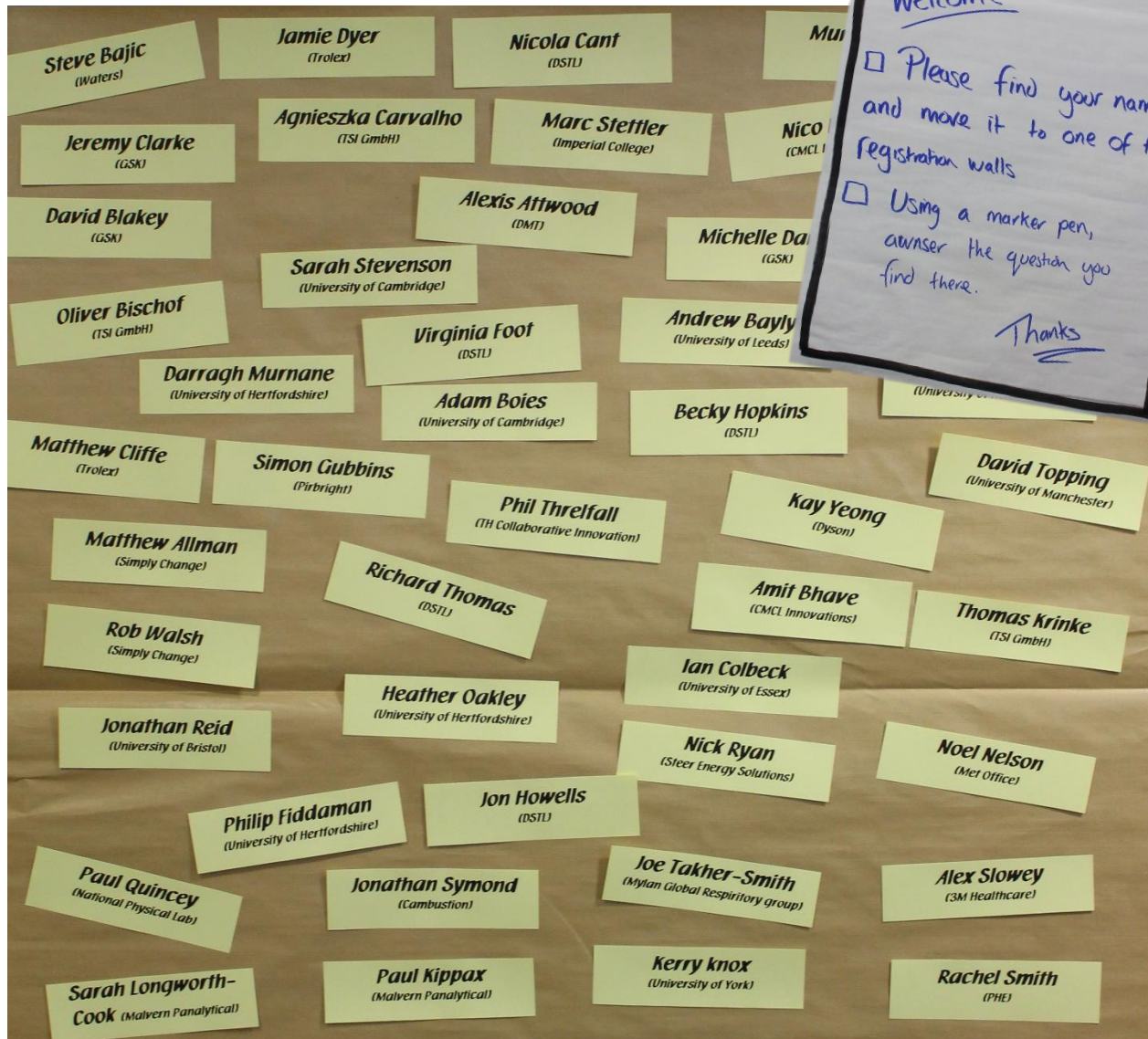


Objectives

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- ☐ To draw out critical research objectives for each specific industry related to this field
- ☐ To explore the training needs for both the current and the future employees in this sector
- ☐ To identify the structures in which this training and education can be delivered
- ☐ To share ideas for ongoing industrial engagement
- ☐ To pull out some key words that can be used to describe the CDT organisation

Welcoming Attendees



Welcoming Attendees

Name	The greatest challenge in Aerosol & Droplet science for me is....	Name	The greatest challenge in Aerosol & Droplet science for me is....
Simon Gubbins (Pirbright)	ROLE OF AEROSOLS IN TRANSMISSION OF LIVESTOCK VIRUSES	Nick Ryan (Steer Energy Solutions)	Taking the science of aerosols into a new industrial environment, the UK Gas Network
David Topping (University of Manchester)	ABILITY TO MODEL ALL CHEMICAL AND PROCESS COMPLEXITY ACROSS DOMAINS	Paul Quincey (National Physical Lab)	MAKING MEASUREMENTS OF THE SAME METRICS COMPARABLE
Nico Bianco (CMCI Innovations)	MULTI-SCALE MODELLING OF NANOPARTICLES, FROM ATOMISTIC TO MOLECULAR SCALE, FLOW AND CONTINUUM SCALE. HAVE THE MODELS COMMUNICATING AT THE DIFFERENT SCALES.	David Hassell (GSK)	DELIVERING THE RIGHT DRUG AT THE RIGHT CHARACTERISTICS TO THE CORRECT LOCATION IN THE LUNG.
Tom Krostrzewski (CN Bio Innovations Limited)	Developing accurate in vitro models to mimic lung exposure to chemical/disease/particle	Paul Smith (Biral)	Improving the relevance of PhD training and accessing aerosol training for non specialist engineers.
David Blakey (GSK)	Understanding + control of surface energy & binding forces to deliver DPT product/animal.	Sarah Longworth-Sorensen Cook (Malvern Panalytical)	Understanding how the different parameters relate to device performance & efficacy impact
Noel Nelson (Met Office)	ROLE OF AEROSOLS IN DISEASE TRANSMISSION + Air Quality Problems	Jonathan Symonds (Combustion)	
Rachel Smith (PHE)	IMPROVING UNDERSTANDING of behaviour in respiratory tract. Training toxicologists/biologists macro/micro in	Joe Takher-Smith (Mylan Global Respiratory group)	Predicting in vivo behaviour of medical aerosols (deposition, adsorbance)
Michelle Dawson (GSK)	Bridge the gap between small particle properties & bulk behaviour	Virginia Foot (DSTL)	Designing feasible ^{small scale} experiments that help real-world measurements + understanding
Kerry Knox (University of York)	Training in complex skills needed	Heather Oakley (University of Hertfordshire)	
Philip Fiddaman (University of Hertfordshire)	BALANCE OF MARKET FOCUS AND FUNDAMENTAL RESEARCH	Alex Slowey (3M Healthcare)	DEVELOP BETTER MODELS (IN-VITRO & IN-SILICO) TO ACCURATELY PREDICT WHOLE LUNG IN-VIVO LUNG DEPOSITION & THERAPEUTIC RESPONSE FOR INHALATION DRUGS (VIA MDI/DPI/SMI ETC)
Adam Boies (University of Cambridge)	Modeling of particle formation and growth within a synthesis reactor.	Thomas Krinke (TSI GmbH)	Improve aerosol measurement methods to make it more consistent, precise, reliable,

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Jeremy Clarke (GSK)	PREDICT PERFORMANCE, MANUFACTURABILITY & STABILITY OF INHALED MEDICINES WITH HIGH FIDELITY.	Agnieszka Carvalho (TSI GmbH)	Aerosol sample conditioning and transport
Mark Knowles (Bespak)	ACHIEVING OPTIMAL DEVICE PERFORMANCE & IN TIME TO MEET CUSTOMER EXPECTATIONS MANAGING SUPPLIER MATERIAL CHANGES IN ORDER TO MINIMISE THE IMPACT TO OUR CUSTOMERS & OUR BUSINESS	Marc Stettler (Imperial College)	UNDERSTAND SCIENCE OF AEROSOLS TO BE ABLE TO DEVELOP INNOVATIVE TECHNOLOGIES, HEALTH TREATMENTS, AND MANUFACTURING PROCESSES.
Alexis Attwood (DMT)	Developing a bioaerosol instrument that meets the needs of the aerosol community with respect to sensitivity & specificity	Martin Irwin (Combustion)	Appropriate error analysis prior to modelling - error propagation
Sarah Stevenson (University of Cambridge)	Gain understanding & capture ideas.	Matthew Cliffe (Troxel)	Modelling biogenic matter interactions in a practical way.
Andrew Safford (Bespak)	Predicting performance after stability storage	Kay Yeong (Dyson)	understanding particle-particle and particle-fluid and particle-surface interactions under dynamic change conditions
Mark Giles (alphasense)	LAB TO REAL WORLD PERFORMANCE.	Steve Bajic (Waters)	TO UNDERSTAND DROPLET CREATION, BREAK-UP & EVAPORATION & CONFIRMATION OF THEORETICAL PREDICTIONS.
Jamie Dyer (Troxel)	Accurate categorisation of particulate matter in real-time	James Humphrey (CRODA)	How formulation designed to be used as aerosols are formulation dependant (eluted)
Paul Kippax (Malvern Panalytical)	Linking data on droplet/aerosol size to formulation parameters.	Steve Nicklin (DSTL)	Art of The Possible
Murray Booth (Waters)	Accurately characterising sub-micron aerosols for mass spec ion source	Becky Hopkins (DSTL)	SENSING + CHARACTERISATION OF AEROSOLS IN THE ENVIRONMENT
John Pritchard (Philips Healthcare)	TRANSLATING IN VITRO DATA INTO IN VIVO EXPOSURE	Jon Howells (DSTL)	DEVELOPING SKILLED PRACTICAL STAFF WITH WIDE VIEW OF APPLIED AEROSOL SCIENCE + SECURITY
Richard Thomas (DSTL)	UNDERSTANDING A MULTIDISCIPLINARY APPROACH UTILISING AEROSOL SCIENCE TO UNDERSTAND BIOLOGICAL PROCESSES	Darragh Murnane (University of Hertfordshire)	
Jonathan Reid (University of Bristol)		Matthew Allman (Simply Change)	
Ian Colbeck (University of Essex)		Rob Walsh (Simply Change)	

Working Together

- ***Start and finish on time***
 - ***Seek to understand***
 - ***One person speaking at a time***
 - ***Monitor your participation and invite others to contribute***
 - ***Ask questions, be curious***
 - ***Assume good intent***
 - ***Give specific examples & explain important words***
-
- ***Record discussions and decisions***
 - ***Park issues if they are divergent or taking too long***
 - ***Phones & Laptops are for break times only***
 - ***If you have to leave early, let us know beforehand***
 -
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Prioritisation of Training and Research



Prioritisation of Training and Research



Prioritisation of Training and Research



Priorities

**What are the priorities for
Research & Training in
Aerosol & Droplet Science?**

Bio-Aerosols

WHICH "BIT" OF THE
ABSOLUTE ALL VIRUSES
IN 2

DETECTION OF VIRUSES IN AEROSOLS

Drying/Expansion

Dry particle engineering

Modelling for drying
eg spray drying

MODEL DROPLET FORMATION FROM LIQUID STREAMS

MODEL EVAPORATION IN COMPLEX GAS FLOWS

Understanding aerosols from agro sprays

Charging

EFFICIENT CHARGING OF
DROPLETS AT HIGH FLOW
RATES ($\leq 2 \text{ ml/min}$)

True effect of charge

Aerosol Lung-Delivery

Modelling for drug delivery to the lungs

How excipients
effect droplet size
inhaled medicine

Behavior in Lungs

Long deposition Modelling - CFD

Particle-Surface Interactions

INTERACTION OF DROPLETS WITH SURFACES (HIGH- We)

Surface Sciences
~~+ interaction physics~~

RAPIDLY DETERMINE SIZE
DISTRIBUTION IN-SITU,
REAL-TIME, GOOD SPA
RESOLUTION

Basic Understanding - Foundations

Statistical + mathematical
of aerosol characterization

Particle/droplet interaction physics.

Hands on experience
with instrument development

Problem solving skills

WHAT IS NAME
Really

PREDICTING DISPERSAL OF
AEROSOLS AT DIFFERENT
SCALES

Aerosol characterisation methods - development.

Basic understanding of aerosol physics

Priorities

What are the priorities for Research & Training in Aerosol & Droplet Science?

TECHNOLOGY DEVELOPMENT

CURRENT STATE

TECHNIQUE + PERFORM

PRODUCT

MARKET

PHARMACEUTICALS

INSTRUMENT DEVELOPMENT

ENGINEERING SKILLS

design, making the experiments

UNDERSTANDING OF THE CHALLENGE OF THE SCIENCE FROM LAB TO REAL WORLD MEASUREMENT OF PARTICLES/AEROSOLS

TO BE ABLE TO ANALYSE THE BENEFITS + DRAWBACKS OF DIFFERENT AEROSOL TECHNOLOGIES + THEREBY IDENTIFY POTENTIAL R&D

Quantification of Metrics

STANDARDISATION

Replacing out-dated techniques/technology

DFx DESIGN FOR...

FIRST PRINCIPLES

APPLICATION OF FUNDAMENTAL SCIENCE

Industrialisation of Common 'Research' techniques

Understanding of fundamental science behind techniques

UNDERSTANDING FUNDAMENTAL AEROSOL SCIENCE THEORY

STRONG UNDERSTANDING OF FUNDAMENTALS

LACK OF KNOWLEDGE ABOUT AEROSOL SCIENCE IN UNDERGRADUATES

USABILITY

TO UNDERSTAND (= BE ABLE TO PROPOSE OPTIMISATION) FOR THE PATIENT EXPERIENCE (= HOW TO IMPROVE COMPLIANCE)

MODELLING + DATA ANALYSIS

UNDERSTANDING HOW TO OPTIMIZE DRUG DELIVERY (YIELD IN THE LUNG)

PREDICTING PERFORMANCE, MANUFACTURABILITY + STABILITY OF INHALED AEROSOL MEDICINES

Universal/Comprehensive Modelling

MULTISCALE MODELLING - ATTEMPTING TO CONTINUITY

DETAILED MODELLING OF MASS AND NUMBER OF PARTICLE (HEALTH IMPACT).

Quantification/Qualification of Measurements

DIGITAL ENGINEERING FOR SOFT-SENSOR DEVELOPMENT

ONTOLOGY OF MODELLING

STANDARDISATION

DATA ANALYSIS TECHNIQUES - ADVANCED - CHEMOMETRICS - STATISTICAL PROCESS CONTROL

ENVIRONMENTAL CONSTRAINT

REGULATORY FRAMEWORK FOR INHALED AEROSOL MEDICINES

ENVIRONMENTAL IMPACT OF AEROSOL

WAYS OF WORKING

Willingness to challenge convention

Analytic skills - (investigative thinking) PROBLEM SOLVING

COMBINATION OF EXPERTISE, e.g. AEROSOL SCIENCE + MICROBIOLOGY

More overlap between disciplines

ONGOING TRAINING FOR INDUSTRIAL STAFF / INTERACTION WITH UNIS

PRACTICAL 'HAND-ON' OPPORTUNITIES ACROSS MULTI-DISCIPLINES (Physics, Chemistry, Biology, Maths)

PUBLIC OUTREACH

Priorities



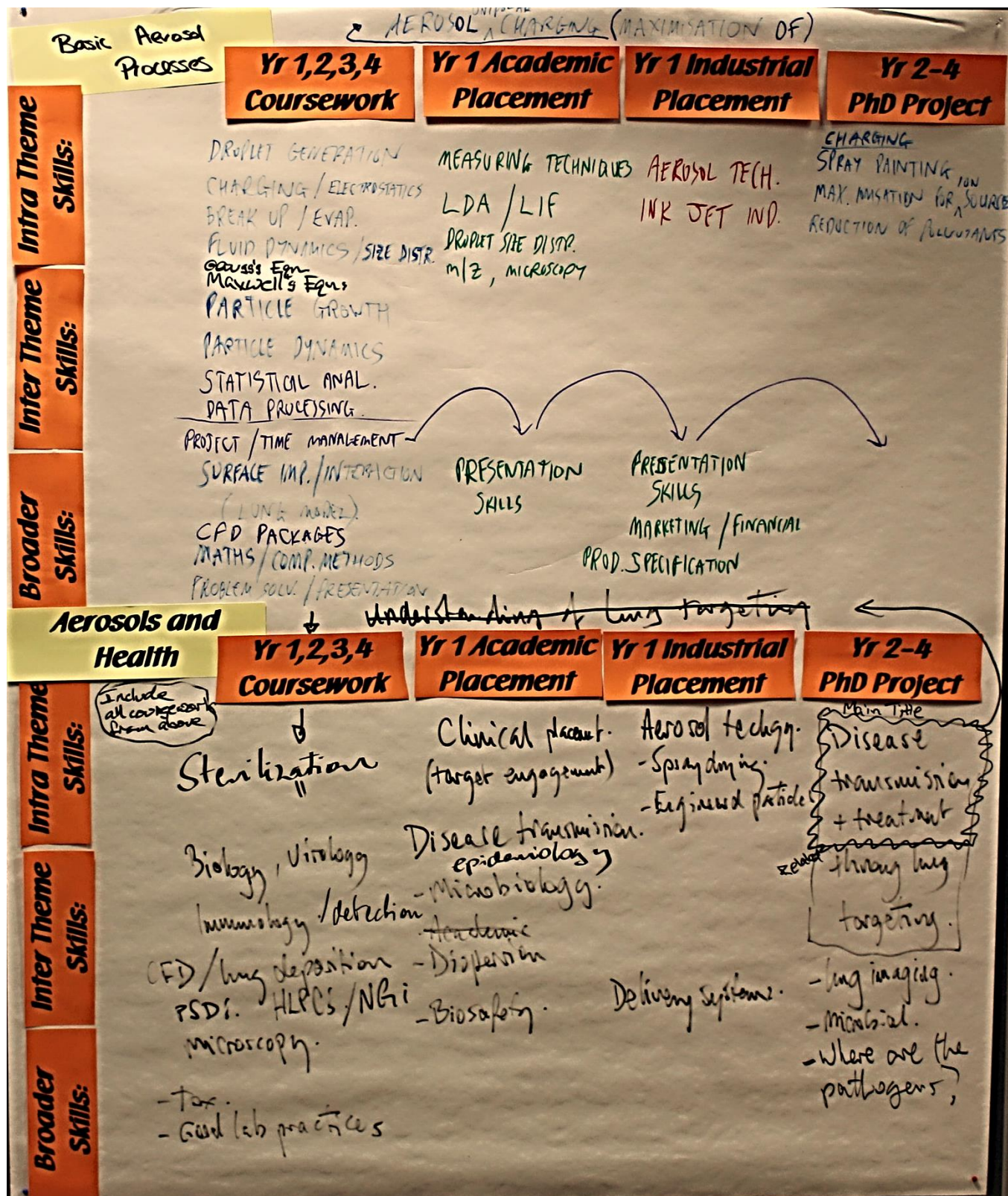
Priorities



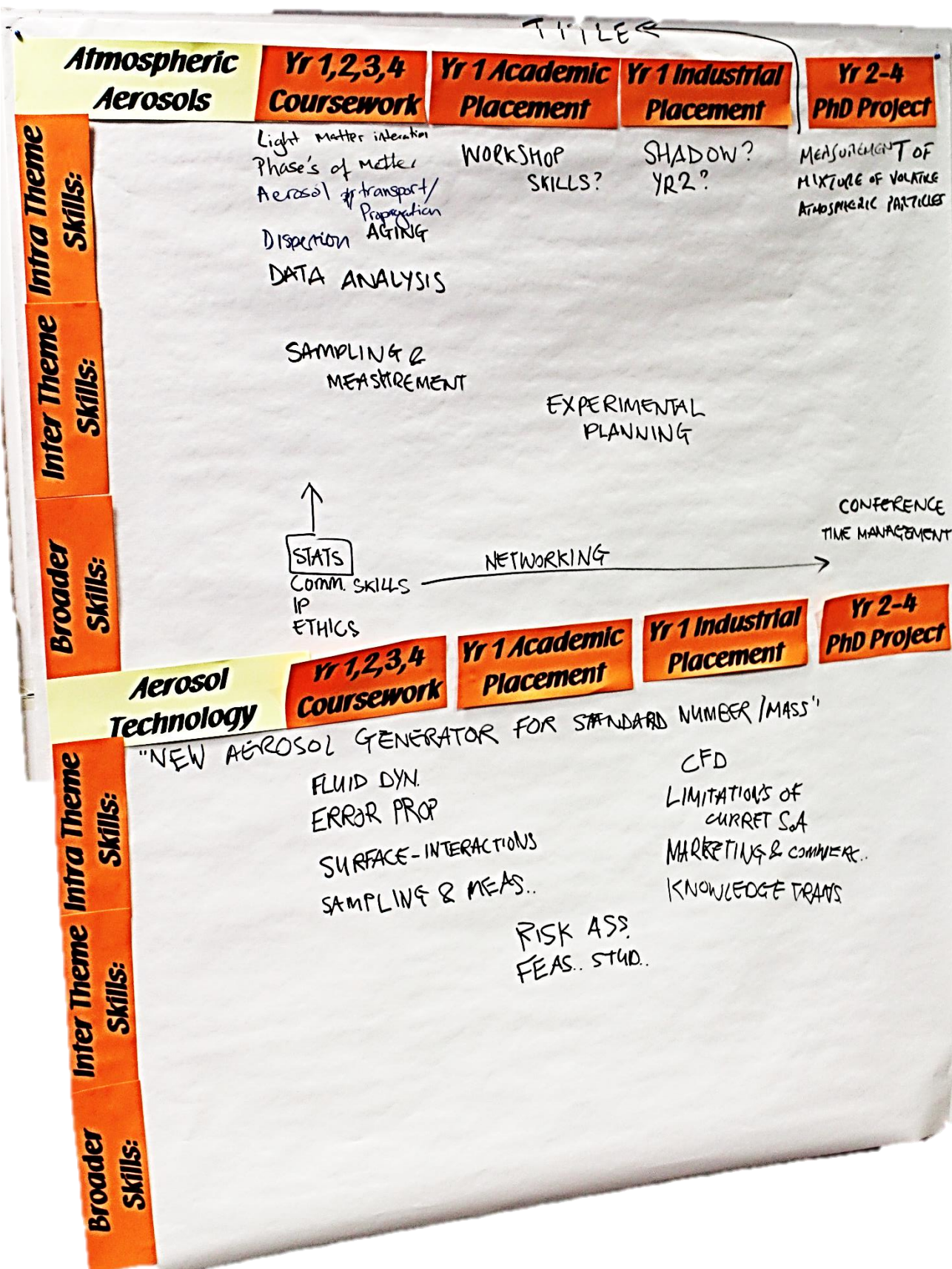
PhD Student Journey



Journeys



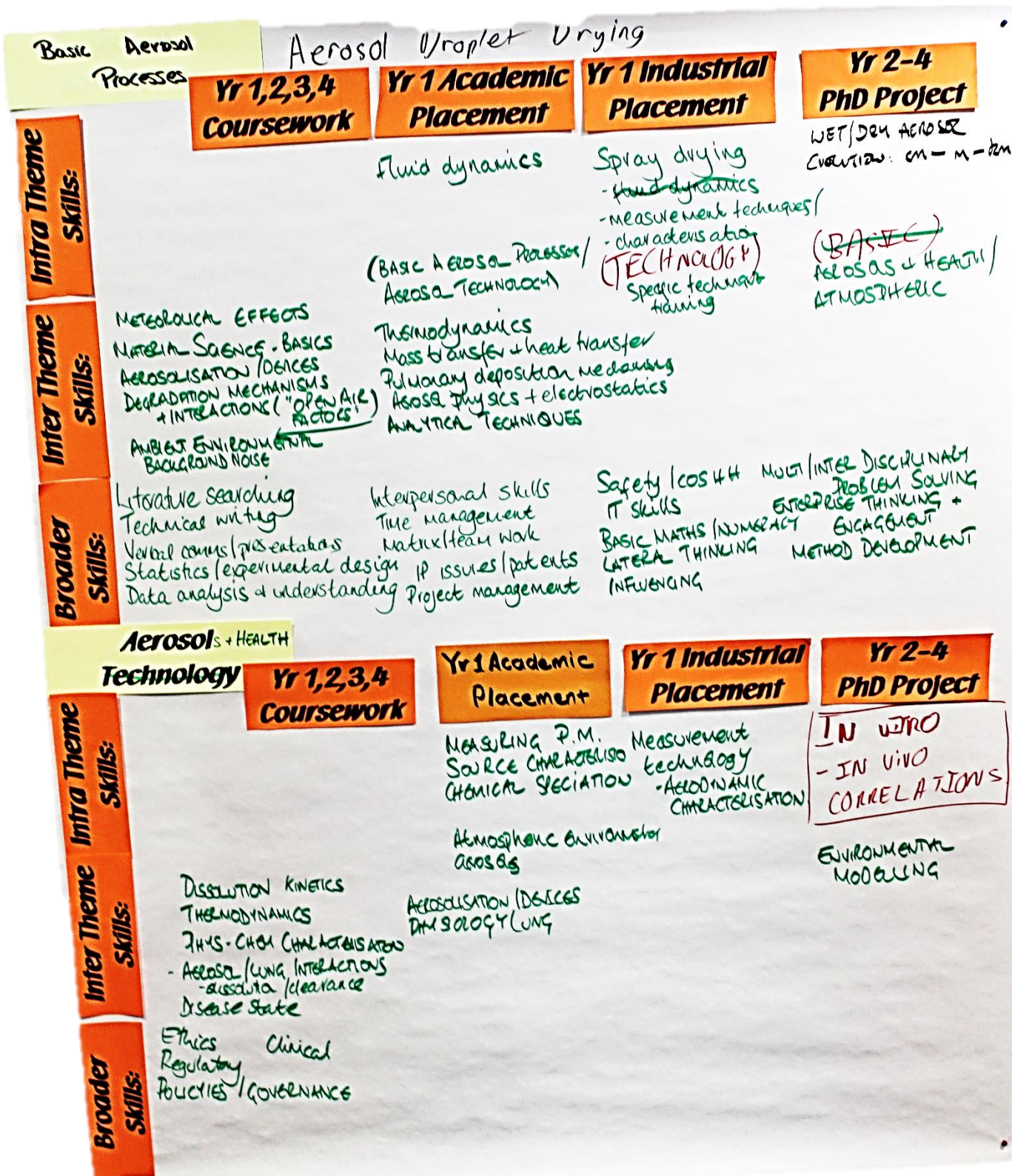
Journeys



Journeys

		Atmospheric Aerosols	Yr 1,2,3,4 Coursework	Yr 1 Academic Placement	Yr 1 Industrial Placement	Yr 2-4 PhD Project
Infra Theme Skills:		atmospheric chemistry cloud physics. METEOROLOGY air quality regulation sources of atmospheric aerosols new particle formation/nucleation kinetics	Fundamentals year 1 Exposure Models. Lab workshops/skills. Statistics. FOUNDATION COURSES IN NON-SPECIALIST SUBJECTS E.G. PHYSICS FOR BIOLOGISTS	CORE TRAINING Aerosol chemistry Transport processes Reaction kinetics Environmental chemistry Exposure Metrology	- more relevant to Year 2 or 3 - 6 months would work for industry - company introduction - Research in real world - Developing new skills - Lab documentation skills - some techniques - H&S - Sampling & Analysis - Test rig design - IP	Penetration of ATMOSPHERIC AEROSOLS INTO INDOOR ENVIRONMENTS
	Inter Theme Skills:	DEPOSITION & RESUSPENSION MATHEMATICAL MODELLING monitoring instrumentation Physics Light scattering Surface Science HEALTH EFFECT, LUNG PHYSIOLOGY Business skills COMMUNICATION Eng. design & build of experiments. Project management. Statistics written presentation skills REPRESENTATION OF REAL WORLD	measurements (Sampling & characterization) Broader Skills 2,3,4 Problem Solving			Annual research review presentations SUMMER SCHOOLS
	Broader Skills:					AEROSOLS IN CLIMATE • Part 1
		Measurement Techniques	Yr 1,2,3,4 Coursework	Yr 1 Academic Placement	Yr 1 Industrial Placement	Yr 2-4 PhD Project
Infra Theme Skills:		CELL BIOLOGY POLLUTANTS/SOURCES Spectroscopy Imaging Techniques Light Scattering metrology standardisation legislative understanding Sample generation Method development / D.O.E	COMPONENT	SPECIFIC AEROSOL CHARACTERIZATION Orthogonal Technique Comparisons	application training Customer visits. H&S as above Fundamental training Assay protocols / design Basics of market assessment / requirements capture.	Differentiation of biological aerosols - prototype and sensing development
	Inter Theme Skills:					
	Broader Skills:	As above				

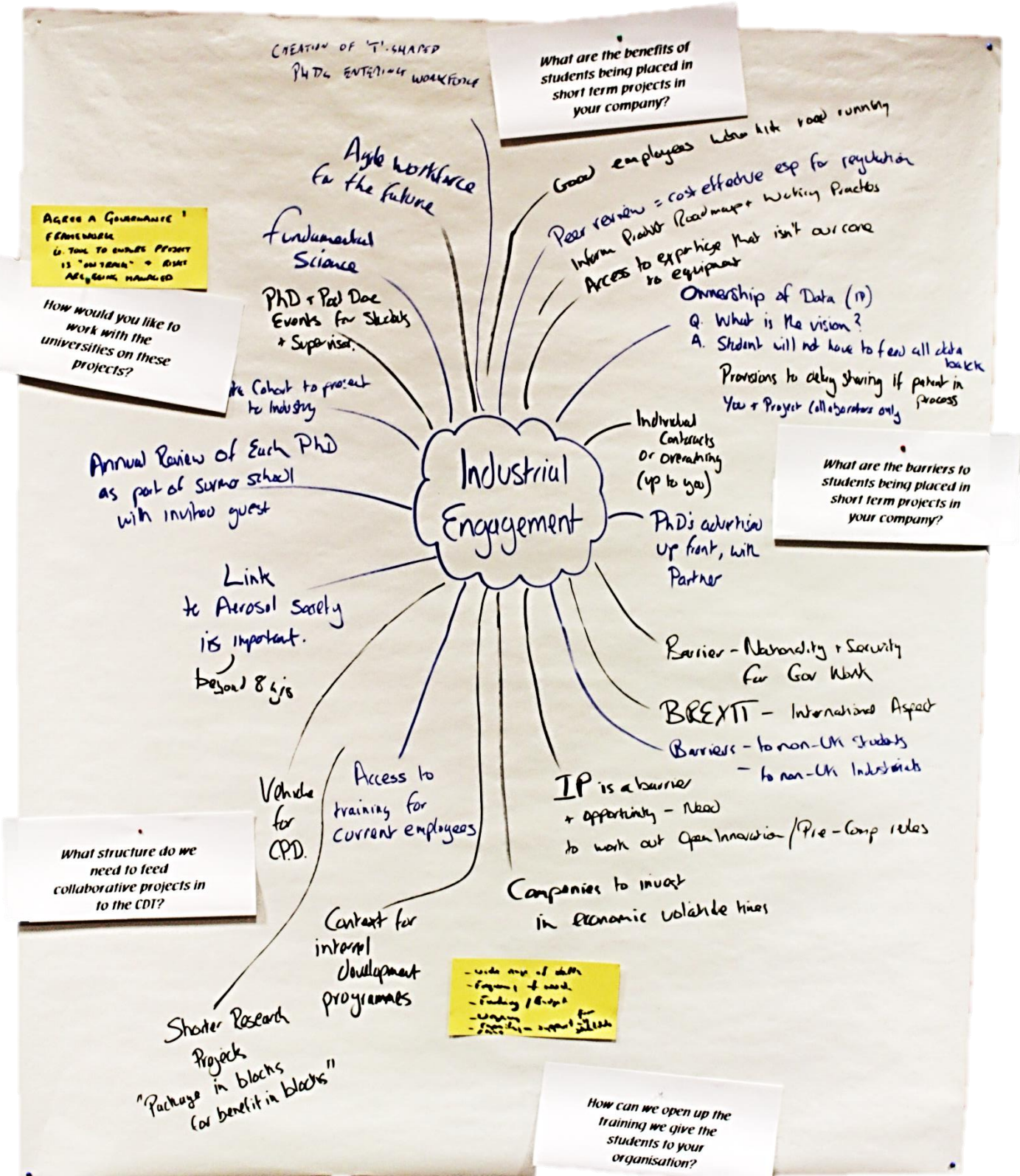
Journeys



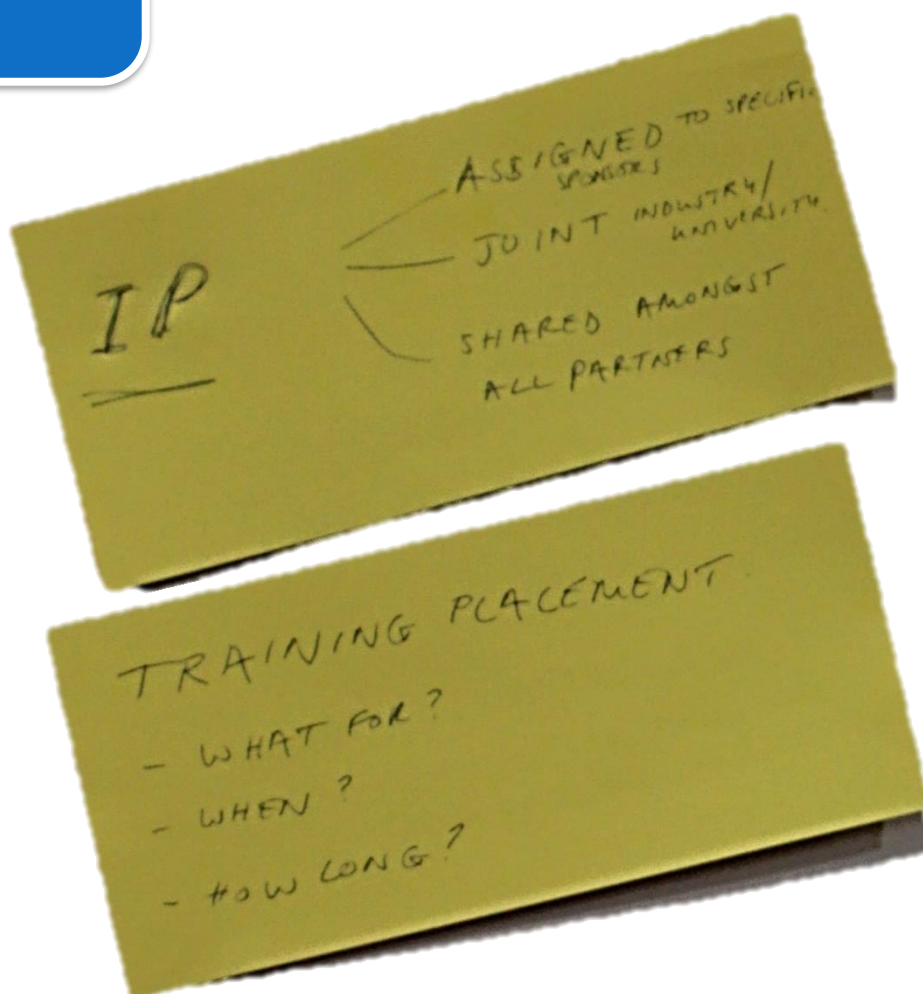
Journeys

Measurement Techniques				
	Yr 1,2,3,4 Coursework	Yr 1 Academic Placement	Yr 1 Industrial Placement	Yr 2-4 PhD Project
Intra Theme Skills:	Electronics Engineering Practical multi-instrument awareness Optical properties / Spectroscopy Aerosol generation Applied metrology	Instrument Practice Analysis of relevant test systems e.g. lung tissue.	Practical application of techniques. • Biopharm, PK etc • Toxicology • rigorous testing methodology approach • working in regulated sector	Measurements of test aerosols in lung lung models. IPR management.
Inter Theme Skills:	PSD Stats Error analysis Fundamentals Sampling & particle transport Gen. Chemistry / Physics Health impact of aerosols Verification / Validation of techniques Choice & Limitation of technique.	Differences between dispersed & non-dispersed aerosols Chemistry / Physics / Biology	Practical techniques Engineering Instrument design	Exposure Systems IP generation Exposure modelling.
Broader Skills:	Collaborative Skills Team working Report writing Data analysis Data management Presentation skills Experimentation Project management Programming	Independent Problem-solving Design of specific experimental approach e.g. sample exposure	Working in regulation Teamwork interdisciplinary Marketing & commercial Presentation data analysis Project management Time management	Report writing Lit search. Project management Independent Problem-solving IP management
Aerosols and Health				
	Yr 1,2,3,4 Coursework	Yr 1 Academic Placement	Yr 1 Industrial Placement	Yr 2-4 PhD Project
Intra Theme Skills:	Ethics Regulatory Requirements Chamber Design Physiology Toxicology Cell Biology ADME / Transport / Deposition Use of Computational Models (e.g. RTdynami)	Deposition System (aerosol to cells)	Inhalation Tox Regulatory context Aerosol characterisation (shape / size etc.) In vivo & In vitro testing systems Understand limitations of systems Chemical Analysis	aerosol fate in RT lung and toxicological effect Advanced Cell Biology Choice of cell types Epidemiology
Inter Theme Skills:	Modelling studies Epidemiology	Epidemiology		
Broader Skills:	As Above.			

Industrial Engagement



The Parking Lot



Feedback

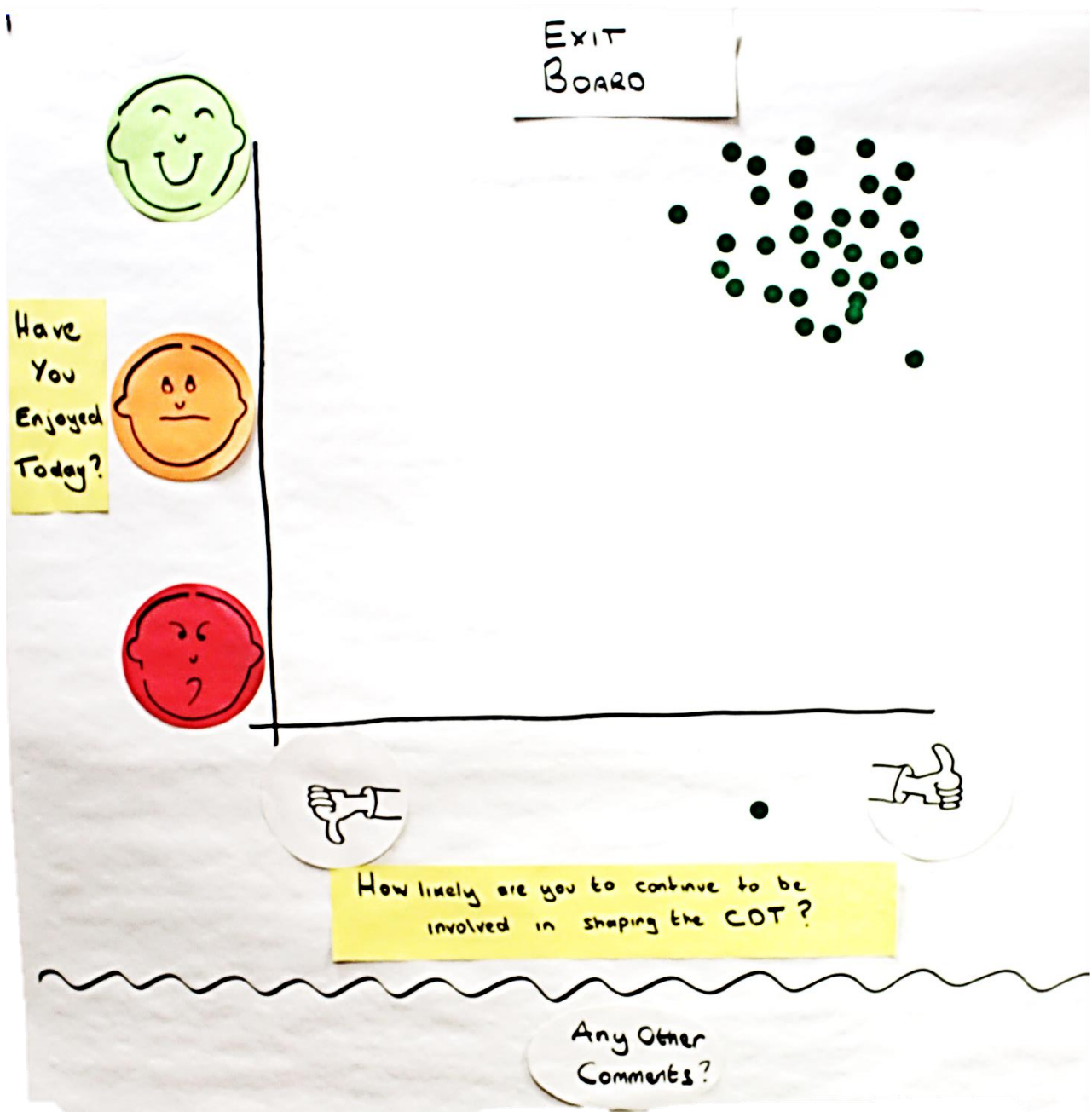
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EXIT BOARD

Have You Enjoyed Today?

How likely are you to continue to be involved in shaping the COT?

Any Other Comments?



ESPRC

Industrial Engagement



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