

5<sup>th</sup> Annual International Zebrafish Husbandry  
Course

# Facility Planning 2016

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# Don't Underestimate the Task!

**Large Team Effort!** - Stakeholders, Estate Services, External Contractor(s), Vendor(s), Finance/Accounts team, Legal team, Facility/BSU Manager

**Politics** - the more stakeholders the more politics. Don't avoid it - due recognition and time should be devoted to ensuring all parties are on board, are addressed early on and on a continuous basis

**Critical** - Ensure your institute 'buys out' sufficient time for the facility manager to attend all meetings. DO NOT just add to existing responsibilities otherwise detail will be missed

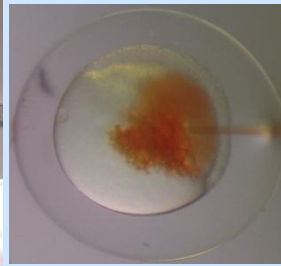
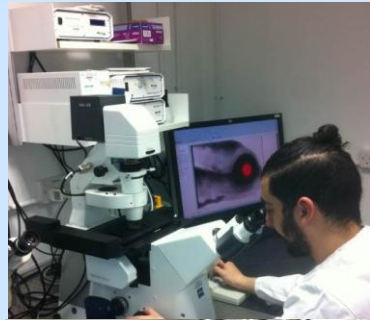
**Engage** - with users as much as possible during the process and before sign off

# Getting Started

Best to start by understanding what is needed to fulfill the needs of the immediate and future expectations of the facility.

First identify the nature and scale of the work you hope to support

Often driven by the institute, change in research focus, appointment of a new PI or a refurbishment of an existing premises



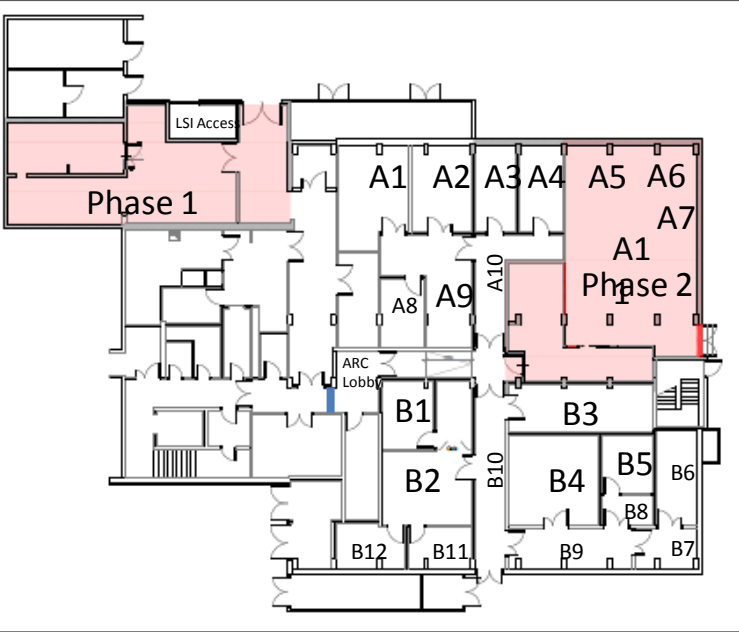
# This begins to define the:

- Various animal rooms
  - Main colony room
  - Quarantine room
  - Flow-through
  - Toxicology
- Ancillary rooms
  - Behavioural science rooms
  - Microscopy/procedure rooms
  - Fluorescent
  - Dissecting stereo microscopes
  - Micro-injection
- Food preparation
  - Live food production
- Water purification
  - Mechanical
  - Life support systems
- Cagewash
- Storage
  - Tanks (plan for 5% more than full capacity)
  - and consumables
  - Chemicals
- Tools and service items

# Site Selection

- By defining the types and number of rooms/spaces you need, you begin to define:
  - Site selection
  - Suitable locations
- Site Refinement – if a site is already provided, you can begin to narrow down what you can actually support in the given location

The Reality may be quite different!



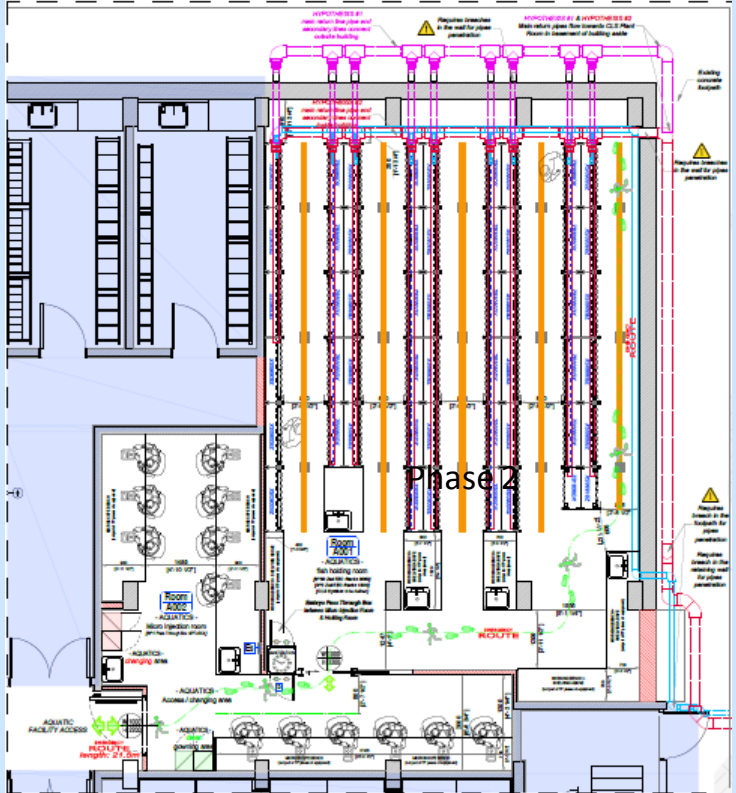
Least impact for current users.

## Can't afford to lose A4.

A5, A6 and A7 already house zebrafish - fine

A8 and A11 imaging and microinjection rooms need re-housing – where do they go during construction?

Can lose office if alternative available?



Phase 2: 3000 x 3.5 L tank capacity.

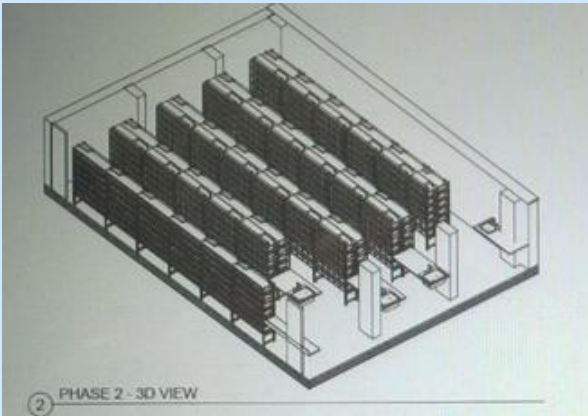
House adult stocks for research.

Quarantine? Nursery? Upscale of food prep (live and other)? More staff and office space required

## ARC Expansion Project:

Phase 2 – Dec 2016/Jan 2017 –  
May/June 2017

Existing system down time?  
How do we interface with  
existing systems?





# The Physical Facilities: The ideal!

Whether a New Build or Refurbishment facilities should be:

Constructed to provide an environment which takes into account the physiological and ethological needs of the species being kept

Designed and managed to prevent access by un-authorised persons and the ingress or escape of animals

Have an active maintenance programme to prevent and remedy any defect in buildings or equipment

Be sited with consideration to the activities in the adjacent buildings from an animal welfare perspective. Facilities forming part of a larger complex should be designed to be self contained

# Establish the Staffing Requirements of the Facility early!

How many people will it take to make this thing go?

- Manager – private office with room for meeting with 1-2 people
- Animal Care Staff
  - 1 person per 8-racks
  - Need
    - break room
    - toilet
    - Shared office resource
- Cage Washer
  - Based on capacity and cage-wash policies
- Technical Staff
  - IT
  - Plant Manager
  - Research
- Easy to focus on infrastructure and forget about staffing after hand-over!



# Assembling the Project Team

Who are the players in the process of building an aquatics laboratory?

- Primary users
  - Pls
  - Facilities manager BSU manager/ UOA manager?
  - Lab manager
- Institutional design team
  - Architect
  - Engineers
    - Structural
    - seismic
    - electrical
- General Contractor
  - Sub contractors
    - Electricians
    - Plumbers
    - Fitters
    - Tinnors
- Capitol Equipment Vendors
  - Animal housing
  - Cagewash
  - Water treatment
- Infrastructure Vendors
  - Water treatment
  - Lighting
  - Power
  - Compressed air
  - IT
  - BMS (can be internal and usually monitors AHUs, lighting), SCADA system for Life-support systems
  - HVAC

# Assembling the Project Team

Who are the players in the process of building an aquatics laboratory?

- Do not forget in your team you need someone with knowledge of....
- Public procurement regulations for the institute – this can have a big impact on the programme - **critical path item** so involve procurement and legal teams early on
- Interdependencies - planning approval, building control, fire officer, HO licence requirements, commissioning of environmental systems, specialist support facilities



# Interdependencies example: Home Office Designation Checklist

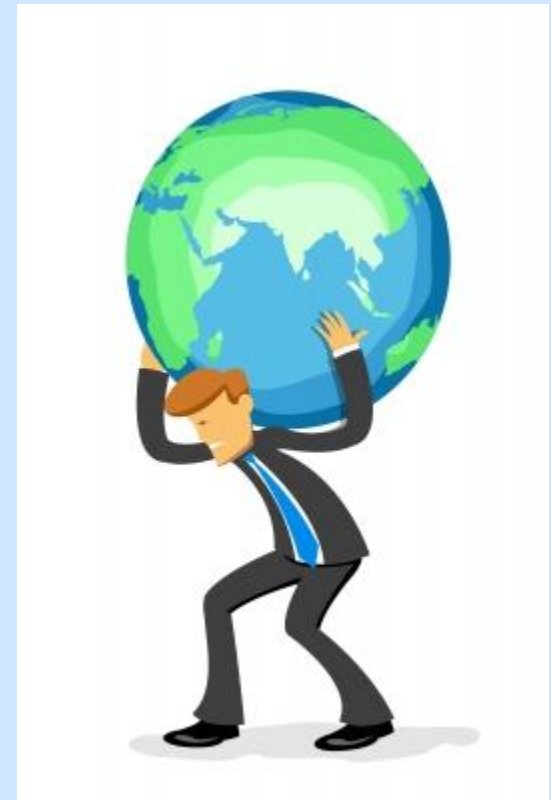
- Building                      Area/Room numbers                      Category of designation
- LTH, STH, SEP, NSEP                      Species
- Information/Task    Responsible                      Completed
  - Set of SOPs
  - Brief description of storage/cleaning facilities
  - Training records/training plans
  - Temperature and room humidity measurements for a 10 day period
  - Room air changes on one occasion from calibrated equipment
  - Noise levels on one occasion, recorded in each room from a calibrated noise meter
  - Lighting levels at bench height for procedural rooms and floor level for holding rooms from calibrated equipment
  - Three conditions measured: Normal, Emergency, Off
  - Written description of environmental systems; in lay language (to include quality of air)
  - Design criteria for all rooms (NR, T, RH, air change, light levels)
  - Evidence of smoke tests
  - Evidence that equipment has been successfully installed and commissioned; evidence of service and maintenance agreements
  - Evidence of processes to address key system failures and evidence of tests – loss of mains power, failure of AHU, Fire alert condition

# Establish a project working group:

- Made of at least one-member from each contributing group
- Minutes to be recorded and published weekly (example: Project Assistant, Estate Services)
- Regular meetings with mandatory attendance
- Project Contact list is critical

# Maintaining Control of the Project:

- Appointed Project Manager
  - Carries the responsibilities for communications, consulting reporting, advising, procuring and signing off in addition to assuming responsibility for the budget, programme and quality of the completed project



# Maintaining Control of the Project:

8 stages



RIBA

The RIBA Plan of Work 2013 organises the process of briefing, designing, constructing, maintaining, operating and using building projects into a number of key stages. The content of stages may vary or overlap to suit specific project requirements. The RIBA Plan of Work 2013 should be used solely as guidance for the preparation of detailed professional services contracts and building contracts.

www.ribaplanofwork.com

Stages	0	1	2	3	4	5	6	7
Tasks	Strategic Definition	Preparation and Brief	Concept Design	Developed Design	Technical Design	Construction	Handover and Close Out	In Use
Core Objectives	Identify client's Business Case and Strategic Brief and other core project requirements.	Develop Project Objectives, including Quality Objectives and Project Outcomes, Sustainability Aspirations, Project Budget, other parameters or constraints and develop Initial Project Brief. Undertake Feasibility Studies and review of Site Information.	Prepare Concept Design, including outline proposals for structural design, building services systems, outline specifications and preliminary Cost Information along with relevant Project Strategies in accordance with Design Programme. Agree alterations to brief and issue Final Project Brief.	Prepare Developed Design, including coordinated and updated proposals for structural design, building services systems, outline specifications, Cost Information and Project Strategies in accordance with Design Programme.	Prepare Technical Design in accordance with Design Responsibility Matrix and Project Strategies to include all architectural, structural and building services information, specialist subcontractor design and specifications, in accordance with Design Programme.	Offsite manufacturing and on-site Construction in accordance with Construction Programme and resolution of Design Queries from site as they arise.	Handover of building and conclusion of Building Contract.	Undertake In Use services in accordance with Schedule of Services.
Procurement Variable task bar	Initial considerations for assembling the project team.	Prepare Project Roles Table and Contractual Tree and continue assembling the project team.	The procurement strategy does not fundamentally alter the progression of the design or the level of detail prepared at a given stage. However, Information Exchanges will vary depending on the selected procurement route and Building Contract. A bespoke RIBA Plan of Work 2013 will set out the specific tendering and procurement activities that will occur at each stage in relation to the chosen procurement route.			Administration of Building Contract, including regular site inspections and review of progress.	Conclude administration of Building Contract.	
Programme Variable task bar	Establish Project Programme.	Review Project Programme.	Review Project Programme.	The procurement route may dictate the Project Programme and may result in certain stages overlapping or being undertaken concurrently. A bespoke RIBA Plan of Work 2013 will clarify the stage overlaps. The Project Programme will set out the specific stage dates and detailed programme durations.				
(Town) Planning Variable task bar	Pre-application discussions.	Pre-application discussions.	Planning applications are typically made using the Stage 3 output. A bespoke RIBA Plan of Work 2013 will identify when the planning application is to be made.					
Suggested Key Support Tasks	Review Feedback from previous projects.	Prepare Handover Strategy and Risk Assessments. Agree Schedule of Services, Design Responsibility Matrix and Information Exchanges and prepare Project Execution Plan including Technology and Communication Strategies and consideration of Common Standards to be used.	Prepare Sustainability Strategy, Maintenance and Operational Strategy and review Handover Strategy and Risk Assessments. Undertake third party consultations as required and any Research and Development aspects. Review and update Project Execution Plan. Consider Construction Strategy, including offsite fabrication, and develop Health and Safety Strategy.	Review and update Sustainability, Maintenance and Operational and Handover Strategies and Risk Assessments. Undertake third party consultations as required and conclude Research and Development aspects. Review and update Project Execution Plan, including Change Control Procedures. Review and update Construction and Health and Safety Strategies.	Review and update Sustainability, Maintenance and Operational and Handover Strategies and Risk Assessments. Prepare and submit Building Regulations submission and any other third party submissions requiring consent. Review and update Project Execution Plan. Review Construction Strategy, including sequencing, and update Health and Safety Strategy.	Review and update Sustainability Strategy and implement Handover Strategy, including agreement of information required for commissioning, training, handover, asset management, future monitoring and maintenance and ongoing compilation of 'As-constructed' Information. Update Construction and Health and Safety Strategies.	Carry out activities listed in Handover Strategy including Feedback for use during the future life of the building or on future projects. Updating of Project Information as required.	Conclude activities listed in Handover Strategy including Post-occupancy Evaluation, review of Project Performance, Project Outcomes and Research and Development aspects. Updating of Project Information, as required, in response to ongoing client Feedback until the end of the building's life.
Sustainability Checkpoints	Sustainability Checkpoint – 0	Sustainability Checkpoint – 1	Sustainability Checkpoint – 2	Sustainability Checkpoint – 3	Sustainability Checkpoint – 4	Sustainability Checkpoint – 5	Sustainability Checkpoint – 6	Sustainability Checkpoint – 7
Information Exchanges (at stage completion)	Strategic Brief.	Initial Project Brief.	Concept Design including outline structural and building services design, associated Project Strategies, preliminary Cost Information and Final Project Brief.	Developed Design, including the coordinated architectural, structural and building services design and updated Cost Information.	Completed Technical Design of the project.	'As-constructed' Information.	Updated 'As-constructed' Information.	'As-constructed' Information updated in response to ongoing client Feedback and maintenance or operational developments.
UK Government Information Exchanges	Not required.	Required.	Required.	Required.	Not required.	Not required.	Required.	As required.

8 task bars



# Designing the Facility

## Layout

- Understanding the Flow of work and traffic
  - Best provided by PI and Facilities and Lab Manager
  - Influenced by legislation and bio-security
- Understanding the realities of space requirements
  - Work with Capitol Equipment Vendors
    - Animal housing
    - Cagewash
    - Water treatment
    - Lighting
    - Power
    - Compressed air
    - IT



# Layout

## Work Flow and Traffic Consideration

- Flow of work and traffic
  - True clean and dirty areas rarely applicable inside main facility
  - Easy access to fish holding areas from both food prep and cage wash of high importance
  - Fish users create high traffic during spawning and mating cage setup times
  - Ensure restricted access areas (e.g. food-prep) are not situated to be short-cuts to other parts of the facility

# Layout

## Fish Rack Layout

- Comb orientation preferable to perimeter positioning
- Less is more
  - Favour more work surface, aisle space, ground and ceiling clearance to more tank space
- Avoid pinch-points in high traffic areas where congestion can be created
- Ensure adequate (quiet) space for spawning tanks

# Layout

## Life Support Systems

- Isolate in purpose built rooms whenever possible
  - Eliminate excess noise
  - Avoid possible contamination
    - Smoke/fire from mechanical failures
  - Ease of access for maintenance



# Layout

## Isolate food production

- Food Prep Area
  - Frozen
  - Dry/prepared
    - Long-term
    - Short-term (in use)
  - Live Feed Culture
    - Rotifers
    - artemia





# Layout — Physical space for Plant



- **Mechanical Space**
  - **Water Purification Plant**
    - **Pre-treatment**
    - **Purification**
    - **Storage reservoirs**

- **HVAC (air handlers)**
- **Electrical Panels**

# Layout

## Ancillary Spaces and Procedure Rooms

- Microscope rooms
  - Fluorescent microscopy requires darkness and isolation from others
- Microinjection areas
  - Preferable to be near spawning areas

# Designing the Facility

## Infrastructure Requirements

### – Power

- vendor input
  - Fish Life Support
  - Cage wash
  - Lighting
  - Water purification
  - Specialized research equipment
- Emergency Power
  - Water purification
  - Fish life support
- BMS (can be internal and usually monitors AHUs, lighting), SCADA system for Life-support systems



# Designing the Facility

## Infrastructure Requirements

### –HVAC

- Location of fresh air intake is critical
- Properly designed capabilities should be ensured at earliest possible time
- Access to equipment needing regular maintenance is critical



# Designing the Facility

## Infrastructure Requirements

### – Plumbing and supply water

- Adequate volume and flow dictated by needs of the life support and cage wash equipment
- Drains should be selected sized to allow for flooding events

### – IT

- Adequate Wi-Fi and ethernet ports to accommodate all equipment and users



# Designing the Facility

## Special Considerations

- Security:
  - Animal facilities should be protected by appropriate security and building measures. Advice should be sort from the institutes own security services and other levels of expertise including local police
  - Swipe controlled door access, CCTV at exits and entrances leading to the facility, fire alarms, intruder alarms, lone worker alarms, alarm reporting procedure, response training



# Designing the Facility

## Special Considerations

### – Noise

- Most equipment has published ratings for ambient noise it creates
- Proper location can minimize potential for ill effects
- Use of Isolators and proper anchoring will minimize ill effects

### – Vibration

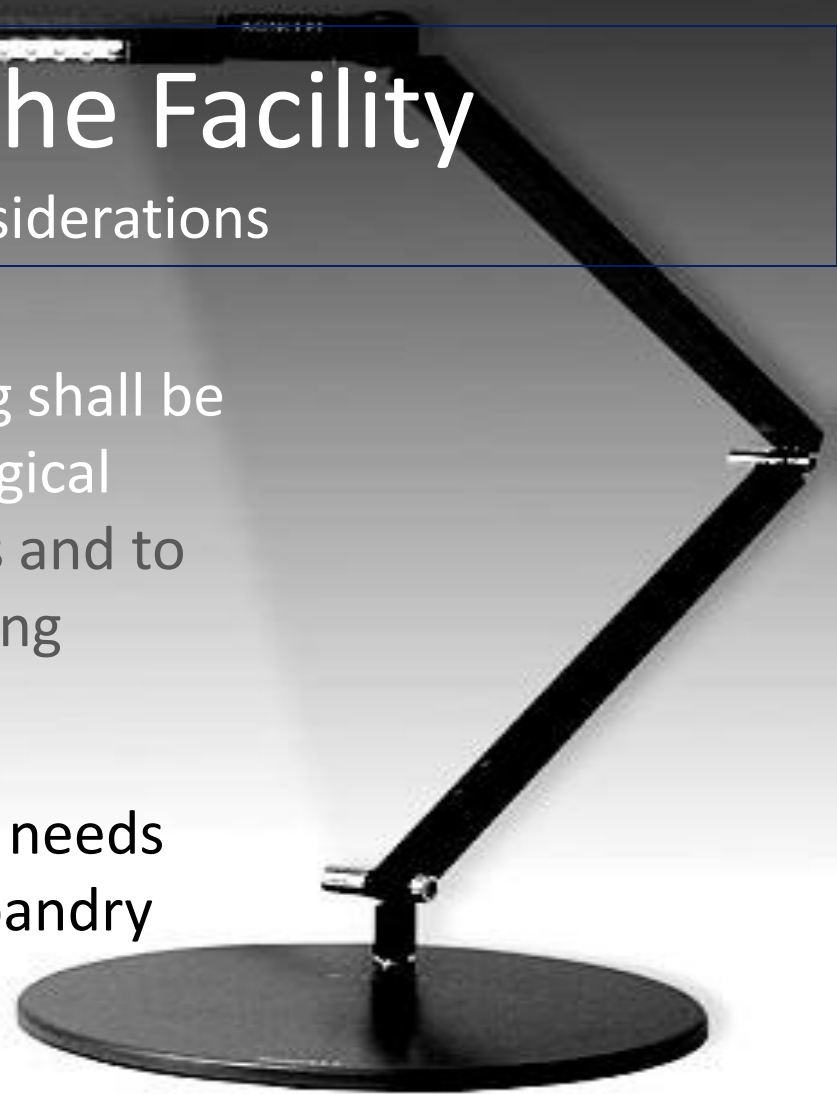
- Not necessarily the same as noise
- Quiet equipment can create vibrations that affect behavior and general well-being of animals



# Designing the Facility

## Special Considerations

- Guidance
  - Lighting – Controlled lighting shall be provided to satisfy the biological requirements of the animals and to provide a satisfactory working environment
  - Illumination shall satisfy the needs for the performance of husbandry procedures and inspection of the animals
  - Regular photoperiods and intensity of light adapted to the species shall

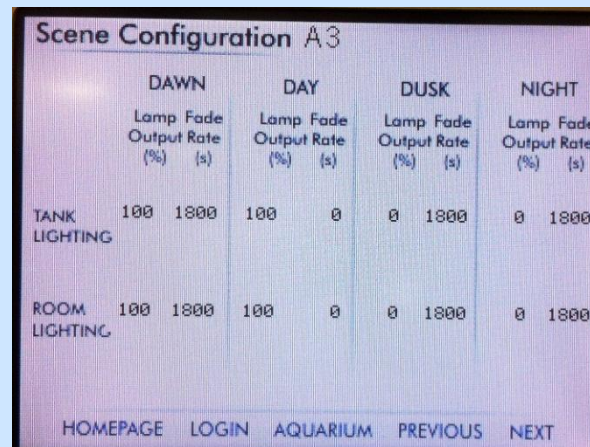




# Designing the Facility

## Special Considerations


- Fish Racks
  - Intensity
    - Fish racks
    - Work spaces
  - Photoperiod
    - 14:10 most common
    - Consistency is key!
  - Dawn/Dusk Emulation
    - Minimize startle response
  - Programmed
    - Let technology do this for you!
    - Many options exist
- Work Spaces/Task Areas
  - Focused lighting inside fish housing rooms is preferable
  - Grid lenses can prevent light from spreading into areas where it is not desirable
  - work surface illumination of at least 300 Lux (30 footcandles)



Scene Configuration A3

	DAWN		DAY		DUSK		NIGHT	
	Lamp Fade	Output Rate	Lamp Fade	Output Rate	Lamp Fade	Output Rate	Lamp Fade	Output Rate
	(%)	(s)	(%)	(s)	(%)	(s)	(%)	(s)
TANK LIGHTING	100	1800	100	0	0	1800	0	1800
ROOM LIGHTING	100	1800	100	0	0	1800	0	1800

HOMEPAGE LOGIN AQUARIUM PREVIOUS NEXT



Aquarium A3

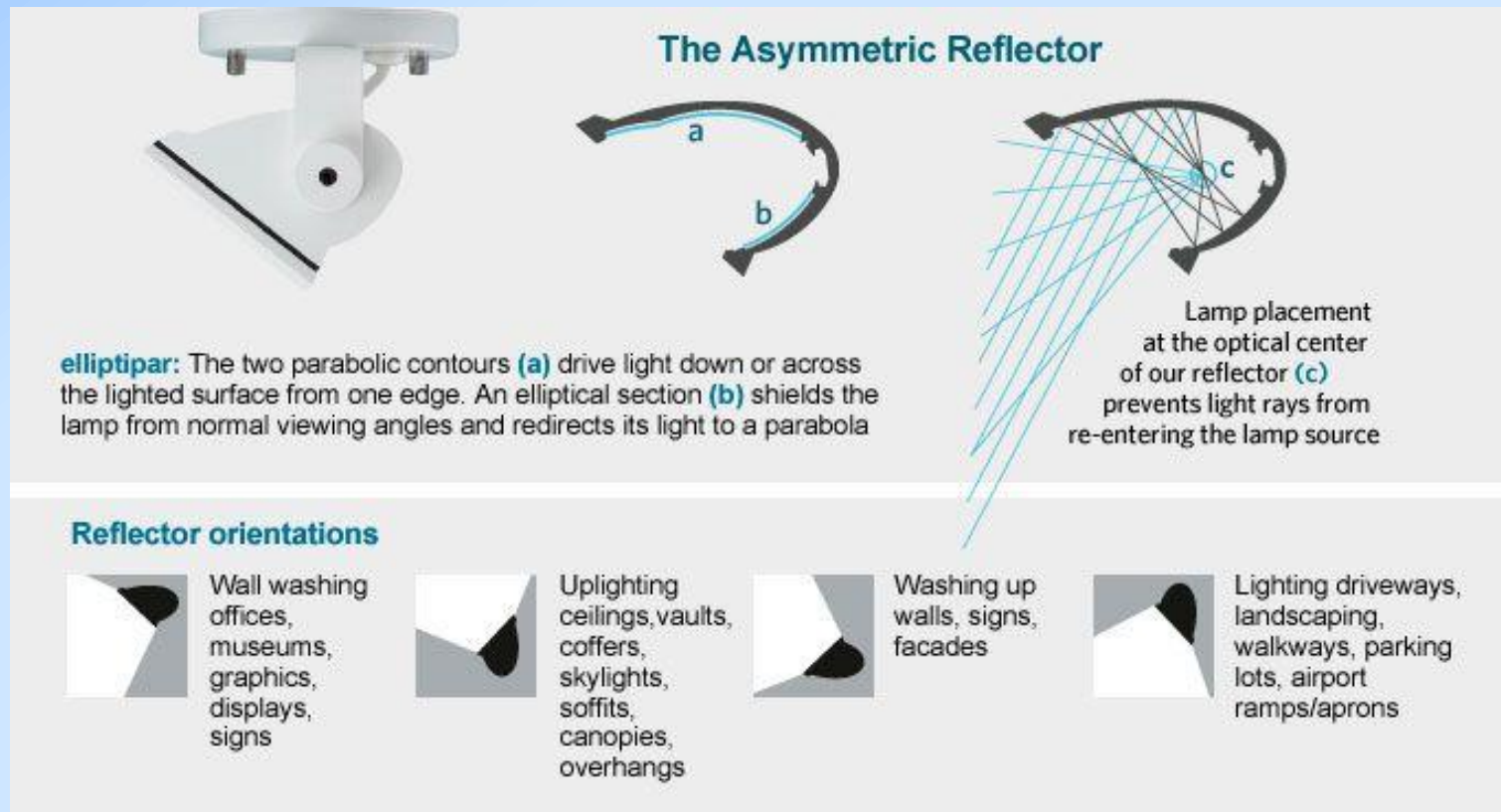
	TANK	ROOM
LIGHT STATUS	ON	ON
LIGHT LEVEL (LUX)	955	243
LAMP OUTPUT	100	100
CURRENT SCENE	DAY	DAY
DIMMING CONTROL	<input type="text"/>	<input type="text"/>
SWITCHING CONTROL	ON	ON
EDIT TIME SCHEDULES 17:09:01		

HOMEPAGE LOGIN AQUARIUM PREVIOUS NEXT

# Designing the Facility

## Special Considerations

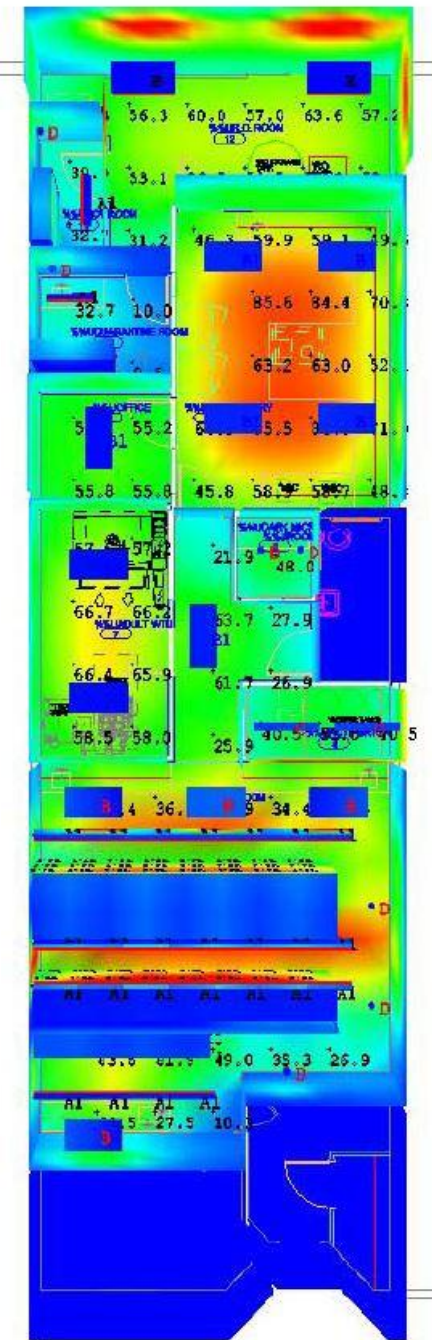
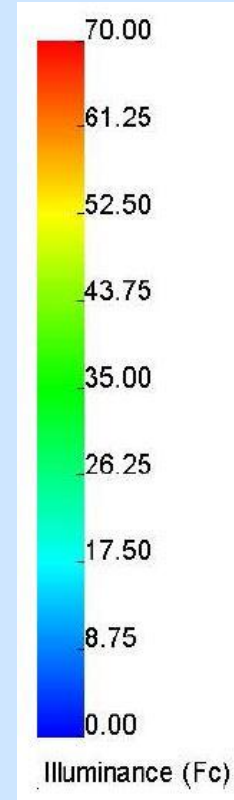
- Lighting – Fish Racks
  - Choices of fixtures can be CRITICAL in fish housing areas to:
    - Minimize algal growth (\$\$\$ cleaning)
    - Minimize stress due to “exposure vulnerability”





## Special Considerations

- Lighting
  - Hire a professional
    - Get professional results



# Designing the Facility

## Special Considerations

- Lighting – Fish Racks
  - The right fixtures can create ideal results at the fish rack level
    - Example: WASHU/Arkana Labs

	<b>ft. cd.</b>	<b>lux</b>
<b>Low-light range</b>	8-20	22-80
<b>activated light range</b>	21-85	230-920

# Appointing the Facility

## Floors, Walls and Ceilings

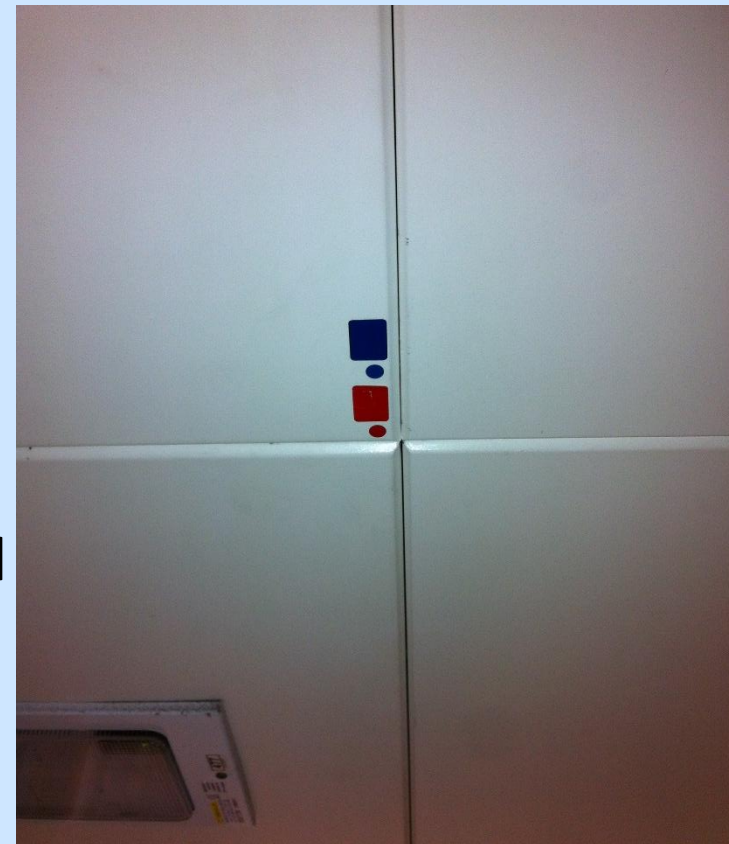
- Floors
  - Epoxy filled quartz aggregate
    - Upstand between floor and wall forming a seal
- Walls
  - Water-based epoxy
    - Permits future repairs without the dangers of VOC
- All washable!



# Appointing the Facility

## Casework, Hardware, Doors

- Casework
  - Must be impermeable, such as phenolic resin
  - Tops should be epoxy or similar
- Hardware
  - 316-stainless steel
  - plastic
- Ceilings
  - Open is best
  - Water resistant tiles for suspended ceilings
  - Hard ceilings need ample access panels and epoxy paint



# Appointing the Facility

## Casework, Hardware, Doors

- Doors, kick plates, push panels edging strips, etc.
- Pipes, Wiring, Cabling, Conduit, etc.
  - advisable to install services in such a way that they are either buried within the fabric of the building, boxed in or clear of the wall surface for easy cleaning





# Example:

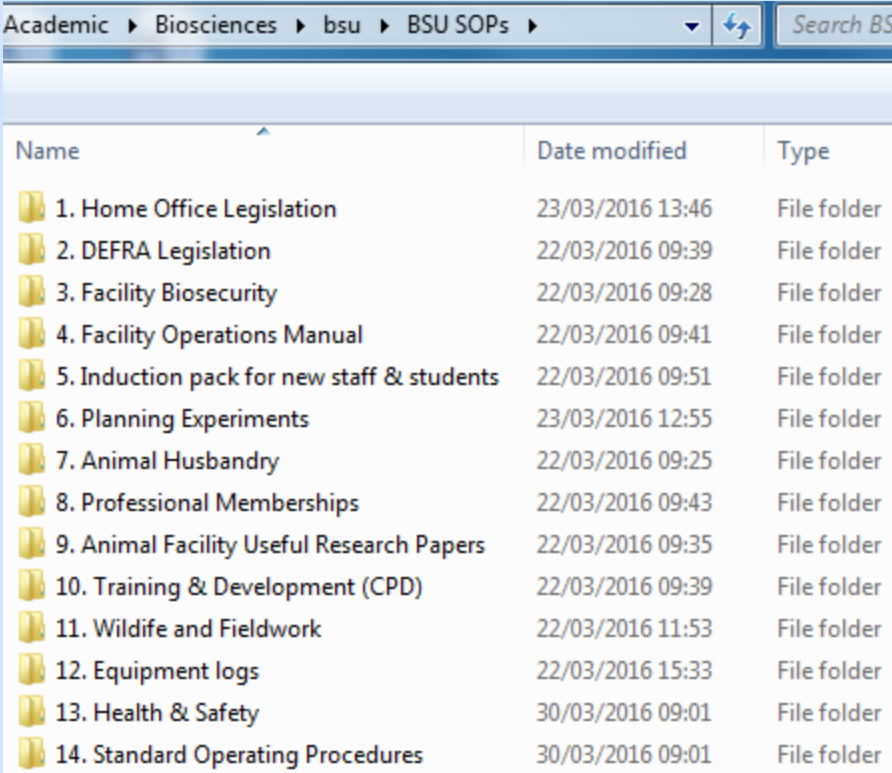
## Final Punch list and Commissioning

In USA, final punch list is where the various groups (A&E, owner, GC, Vendor, etc. walk thru facility and ensure that all things are completed according to agreed plan.

In UK, Home Office Designation Checklist

Post Occupancy Appraisal carried out to assess lessons learned and validate project deliverables in the original business case

**THEN THE REAL WORK BEGINS**



The screenshot shows a Windows File Explorer window with the address bar set to 'Academic > Biosciences > bsu > BSU SOPs'. The main area displays a list of 14 folders, each with a yellow folder icon. The columns are 'Name', 'Date modified', and 'Type'. The folders are numbered 1 through 14.

Name	Date modified	Type
1. Home Office Legislation	23/03/2016 13:46	File folder
2. DEFRA Legislation	22/03/2016 09:39	File folder
3. Facility Biosecurity	22/03/2016 09:28	File folder
4. Facility Operations Manual	22/03/2016 09:41	File folder
5. Induction pack for new staff & students	22/03/2016 09:51	File folder
6. Planning Experiments	23/03/2016 12:55	File folder
7. Animal Husbandry	22/03/2016 09:25	File folder
8. Professional Memberships	22/03/2016 09:43	File folder
9. Animal Facility Useful Research Papers	22/03/2016 09:35	File folder
10. Training & Development (CPD)	22/03/2016 09:39	File folder
11. Wildlife and Fieldwork	22/03/2016 11:53	File folder
12. Equipment logs	22/03/2016 15:33	File folder
13. Health & Safety	30/03/2016 09:01	File folder
14. Standard Operating Procedures	30/03/2016 09:01	File folder