Innovation and Product Development for Industry 4.0 - ACPA 6000 – Management of NPD Assessment B Developing the Design Brief

ACTIVE - The Hand-Held Chemical Detector

Product Design Brief

- **A** - Aerosol
- **C** - Chemical
- **T** - Trace
- **I** - Indication (&)
- **V** - Virus
- **E** - Evaluation

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1. Background Overview and Introduction

Dear Colleagues.

As many of you are no doubt aware, on the back of the success of our Alcohol testing equipment we are looking to take up the exiting opportunity to expand our product portfolio, to embrace new technologies for our ever changing world and the demands and the difficulties currently presenting themselves.
Through some innovative use of different detector types, we now have the potential to detect many ailments and viruses through the analysing of exhaled breath.
From Food allergies to various cancers, Liver disease, Kidney disease to COVID-19.
We wish to introduce a new way of multi-departmental input into the design and feasibility of this new product.

- In the coming pages you will see our design brief. This is a valuable project management tool.
- By incorporating all the items considered within the contents above, we have the bones to put together an effective strategy to guide our product development.
- Through multi-departmental input and buy-in we can minimise miscommunications, mitigate risk, and effectively manage our resources.
- A thorough design brief will ensure that the final design solution successfully and efficiently addresses the problems that we are setting out to solve.
- Please read the following brief prepared.
- It will be a living document to support our whole design and integration process of this new product.
- Your participation and active feedback will be warmly welcomed..
- Could I request that you endeavour to participate in all the periodic team meetings, perform tasks and provide any feedback when requested efficiently and succinctly.
- A great team effort will reduce the risk of any future issues.

Thank you.
Gerard Logan
Innovation Manager

The Inter-departmental Team

I. Wanda Costa – *Technical Sales*
II. Drew Tings – *Design / Technical*
III. Fashion O'Toole - *Tooling*
IV. Gerard Logan - *Innovation Manager*
V. Izzy Aliev - *Production*
VI. Niall Onn - *Materials*
VII. Packie Boxer - *Logistics and Packing*
VIII. Pat Checker - *Quality / Compliance*
IX. Penny Pincher - *Financial Administrator*

2. Considerations:

2:1 Aesthetics -

- The main considerations would be the functional ‘style’ and ‘substance’.
- Most of the similar products of this type would be of the classic ‘Walkie Talkie’ type design.
- It does not have to be overly pretty or stylish and refined.
- The functionality is of more importance than an over designed stylish item.
- The colour should be subtle,
- We should have colour controls in place for repeatability.
- We should not offer different colour options so that hat the consumers are not given choice to complicate production processes i.e. black/grey shades.
- This would also fit with most corporate or Clinical consumer requirements.
- The display could either be small with push button pad for functions or be a large touch screen similar to a cellular phone.
- A touch screen offers the advantage of less parts to assemble, less holes in the body for dust or water ingress and it would be able to be wiped clean and offers a more hygienic option than the push button arrangement.

2:2 Branding -

- Should be subtle and not overpowering as many of the targeted ‘professional’ customers would not want something of that type.
- Professional bodies would not want anything overpoweringly garish and bold.
- Our company name, the ACTIVE name should be prominently on the front face, the home screen would show other information when the device powers up.
- Any regulatory safety and operational advice would be positioned on the rear face. Such as model number, material and electrical requirements.

2:3 Company Constraints -

We need to assess what we will do ourselves and what we could outsource.

- Electronics and Display (currently outsourced but could it be feasible to bring this in-house?)
- Mouldings (currently outsourced but could it be feasible to bring this in house?)
- Assembly Lines
- Marketing Activities
- Packaging activities
- Direct Sales / Outsourced Sales
- Shipping / Deliveries
- Personnel availability and training
- Capacity of machines and personnel.

- Can we repurpose existing facilities? Or dual use?
- Can we re-purpose any existing tooling and machinery? Different plates in tooling?
- A comparison of the envisaged current costed in house manufacture against outsourced manufacture should be quantified (May see a reduction in fixed costs and or capital expenditure requirements but also delivery / shipping costs must be evaluated)
- Team development from production operators to management
- Multi skilled for job rotation and work force flexibility.
- New techniques and thinking in international sourcing and procurement for tooling, components and ancillaries.

2:4 Competition -

- What is already out there?
- What are our competitors offering?
- Can we improve upon their offering?
- We need to assess all the competitor product offerings on the market and understand what their good points and bad points are.
- Is there a market leader or leading brand competitor that we should aim to beat?

We will present, on an indicative chart such as that below, the determining factors in an easily understandable matrix to indicate our competitor good or bad characteristics.
i.e.

- Expensive vs Inexpensive,
- Stylish or Refined vs Robust or Functional,
- Fussy or Expressive vs Reserved or Minimal.

Example comparison matrix

2:5 Customer -

In the same manner that the Competition was assessed, the Customer can be assessed. In the table above, the customer wants / needs can also be evaluated.

- Female vs Male,
- 'Consumer Tech" vs Professional,
- Clinical vs Workplace.
- All potential consumers should be evaluated using proven assessment tools and data gathering tools to assess whether they have a specific requirement that could have been missed within the other consumers assessments. This could also be utilised to evaluate whether they would be seen as a main target customer to be focussed upon.
- From research performed by our University partners, the potential target consumers are everything from Clinical Professions and establishments Hospitals, Dentists, GP surgeries), Care Homes, Large Scale Event Management and Hospitality.

2:6 Circular Economy -

- Is the item intended to be serviceable?
- Is the item intended to be recyclable?
- Are we required to submit an end of life directive declaration?
- Will we offer upgrades to the detector or the operating system / firmware?
- Should we offer discounts on return customer trade-ins?

2:7 Documentation -

What level of sophistication should any supplied documentation possess?

- A "Quick set-up" fold out pamphlet? (Multi Language?) Text or simple diagrams?
- An in- depth instruction manual? (Multi Language?)
- Guarantee / Warranty document (Multi Language? And local agents?)

2:8 Environment -

What sort of environmental conditions is the item likely to experience?:

- Indoor / Outdoor operation?,
- Hot / Cold conditions?,
- Wet / Dry conditions?
- Low light or Night / Bright light / Daylight, (Should we offer a backlight or dimmer?)

Should we offer add-on items such as:

- a hand strap,
- a grip case,
- a protective case
- a waterproof case?
- The provision of docking stations could also assist with safe storage when not in use.

2:9 Ergonomics -

- Our existing product is of “Walkie Talkie” size.
- Our University partners have undertaken a study to investigate the dimensions that can be easily handled by male and female subjects – (See 2:31 – Size)
- The new product package should ideally be of similar dimensions and easily portable by both male and female operators and used in many various applications
- Transportation as an ‘in the pocket’, an ‘over the shoulder’ or a ’clip on’ device that should not result in any great inconvenience through size, weight or discomfort.
- Should ridges be added to the product body to enhance the grip and reduce the likelihood of the product slipping through cold (numb) or hot (and sweaty) fingers / hands in extremes of temperature?

2:10 In service life -

- How long is a reasonable service life for the item in its entirety to realistically last?
- How long should support options be offered?
- Any ancillary components such as plug in chargers / power packs should reasonably be expected to last for that lifetime also.
- Testing of these power sources and their charging cycle lifetimes should be considered.
- Would “AA” batteries be a better more flexible solution than dedicated power packs? Will we offer upgrades? Operating System, Firmware, Detectors etc.

2:11 Installation -

- How easy do we wish for the initial use straight from the box to be?
- Is it a 'switch on and use'? or is some simple assembly or set up required?
- If it is as envisaged to be used by a wide spectrum of society then a simpler assembly and set-up would be desired.

2:12 Intellectual Property -

- We are allocating a lot of our resources into our venture; it is only right that we protect our investment in every way possible.
- Any outsource partners should be requested to sign a Non Disclosure Agreement to ensure a legal standpoint on confidentiality.

2:13 Legal -

- We do not have any legal resource within our company structure so the advice of a Specialist Solicitor should be sought in which we can best protect our product throughout the scope of our intended sales coverage. Patents etc.
- Terms and condition of sales and aftermarket.
- Is GPDR infringed through the data capture and sharing?

2:14 Materials -

- Do we stick with the standard materials that we already know and use which are reliable 'in the field' on our existing products?
- Do we take the opportunity to source alternatives? Cheaper, new, potentially better suited types? The cost of testing would have to be accounted for.
- Do we look into a 'Unique Selling Point' such as plastics obtained from sustainable sources?
- Are there any lessons learned from our existing material portfolio that would steer us in a particular direction / application / supplier?
- No restricted materials or materials from undesirable countries should be utilised.
- Availability of thermoplastics,
- Thermoplastic standards, suitability and specifications (ASTM, JIS, BS, ISO, DIN)
- Material compound colours – mixed by moulders or bought in ready mixed for repeatability? (RAL references?)
- Incoming packaging (one use or returnable?)
- Quality and reliability of material and supplies,
- Thermoplastic Shrinkage,
- Industry standards for metals brackets and fixings (BS EN…)
- Manufacturing facilities and locations.
- RoHS (stands for Restriction of Hazardous Substance) and affects many electronic products. If a product is RoHS compliant then it has been checked for hazardous materials and been cleared. Most CE products should also be RoHS compliant.

2:15 Manufacturing Facilities -

Following on from '1:3 Company Constraints', our capability to make these extra items within our organisation should be fully assessed.

- Personnel skills / capacity,
- Machinery size / capacity,
- Quality Control validation resource,
- Incoming checks,
- Component and stock control potential issues,
- in-process evaluation of product and frequency,
- Warehousing and Packaging operators.
- Re-use of existing tooling and equipment for similar processes,
- The development of new production lines and techniques,
- The development of new assembly lines and techniques,
- Is sourcing tooling from cheaper markets such as China and the Far East a viable option?
- Might moulding parts in cheaper markets such as China and the Far East a viable option?

Shipping times and methods and the costs associated would have to be assessed against performing moulding activities in the UK and should be well researched. There are many factors that can easily cause delays in shipping both by air and sea such as acts of nature, shipping accidents, conflict and pandemic lockdowns as we have seen in recent times.

2:16 Marketing Constraints -

- Should we sell direct to agents / wholesalers / shops for them to sell on to consumers?
- Should we offer direct sales direct to consumers?
- Direct sales would be an opportunity to maximise our profit margins but comes with the incurring of more in the way of customer service and after care activities, whereas 'agents' will often deal with much of the incumbent after sale themselves. We would also require dedicated sales staff.

2:17 Maintenance & Repair -

- A one-year warranty is the industry norm.
- Do we stick with this or are we confident enough to offer more?

- We would need to assess how good our product actually performs through long term continuous in the field testing.
- Should we directly offer our own Calibration, Maintenance and Service / Repair service?
- Should we just replace defective goods? (Perhaps repairing and refurbishing?)
- Should we offer a spare parts service for out-of-warranty products should persons require?
- Should we offer a service plan for customers who retain a large amount of our product? Large organisations such as Heath Authorities and |Event Management.
- Should we offer a service plan for all customers?
- Should we offer a 6 or a 12-month calibration service?

2:18 Packaging -

- The size of the actual part would be decisive in any decisions reached on what packaging would be required following assessment.
- Is additional packaging also required? (such as protection sleeving, pop packaging etc.)
- If we stick to our earlier wish to produce an item that is very similar in size to our existing breathalyser products, then we should already have existing suitable packaging? On the primary product packaging the branding/imagery can be altered by the supplier to suit the new product, with our organisation's current bulk packaging being carried over and utilised.
- If this is not the case, then new bespoke packaging and protection would have to be investigated and sourced. Not desirable as we would be incurring extra costs.
- Should we use a classic cardboard rectangular box or one with a clear window to show the product inside? (Cost over aesthetics)

2:19 Performance –

- The Long-term material performance should be assessed (Fading, robustness etc.)
- The Long-term mechanical reliability would need to be assessed.
- The Long-term reproducibility of results would need to be assessed.
- Six monthly or Annual calibration could be offered as an additional income stream. This would also provide data as to the reliability, robustness and reproducibility of results over given time periods.

Other features that might be desirable:

- The ability to store a considerable amount of test data internally,
- Time and date recording (future proof)
- Wi-Fi connectivity,
- Blu tooth connectivity,
- A Removeable memory card?
- A wired output port connection,
- The ability to output to a printer or pc,
- GPS data for in built location records.
- Communication to Track and Trace bodies to share information (and receive?).
- A rudimentary camera to photograph the subject, if required, for traceability or litigation purposes.
- A quantifiable 'Time' between charging or changing the powerpack or batteries. (Hours use, number of tests etc.) An indication of this could be shown on the product screen to assist with charging and in the field use..

2:20 Politics -

Internal

- What one department might see as a requirement might not be seen in the same way as another department and vice versa.
- The internal divisions / politics should be minimised by the involvement of at least one representative from all the interested parties with a vested interest and ownership in the process from receiving the constituent parts and materials all the way through to the delivery of the product to the customer.

External

- An assurance should be sought that no designs have been infringed by the design and technologies utilised by our product.
- Any warranty or external customer issues need to be managed to ensure the best relationship possible with any consumer be they big or small.
- Any pertinent legislations both in UK and internationally should be investigated.

2:21 Processes -

- Bought in parts?
- Incoming checks,
- Batch processing?
- In-line production and assembly?
- In-process / assembly poke-yoke checks?
- Marketing and Sales,
- Warranty,
- Calibration, Service and Repairs.
- Consumables.
- Spares
- Aftermarket goods – cases, straps etc.

2:22 Prototyping -

- 3D CAD Modelling, Rendering,
- 3D printed samples,
- Mock-ups, both virtual and physical,
- Trials and feedback,
- Electronic testing – the checking of circuitry externally from the device before packaging around it
- Detectors – what else can they actually detect?
- Displays and buttons – robust and easy to use/read.
- The product processing capabilities 'The analyser's brain',
- Consumables - such as the mouthpiece.
- Protection – cases etc.

2:23 Product Cost -

- The sum of the constituent parts and the assembly/packaging process has to allow for the feasibility of a selling price that is profitable for our company as well as being acceptable to both the larger organisations and individual consumer.
- Sales, Marketing and Finance involvement and feedback is critical.
- A budget plan would be good practice and a desirable prompt for contingency planning. With the use of baseline timing against actual timing would help with data for future projects.

2:24 Product Life Span -

- The recommended life span of similar "detectors" such as alcohol breathalysers is generally in the area of circa 5-10 years.

- Calibration and servicing at regular intervals (6 to 12 months) would be recommended as a requirement.

2:25 Quality -

- This should be the responsibility and ownership of all colleagues.
- Incoming checks on all incoming outsourced components and assemblies will be put in place.
- 'Multi-Layered in process checks' and 'buddy checks' will be put in place with positive records kept of each of these checks having been performed.
- Poke Yoke in process testing checks at key positions on the assembly line.

2:26 Quantity -

- Will one device be able to be a one-stop shop option?
- Would size be affected if this were feasible and offered?
- Would accuracy be impeded if this were feasible and offered?
- Would it still be packageable?
- Will several specialist '# trick pony' devices be required for diverse detection applications?

- How many can be shipped in a bulk box,
- How many can be shipped in a Pallet? (See 2:18 Packaging & 2:31 Shipping)

2:27 Reliability -

- Because of the nature of the device, accuracy and reliability would be paramount.
- A quick result within circa 10 to 15 seconds would be desirable.
- Battery life

2:28 Safety -

- Size and weight are the main factors in attempting to avoid Muscular-skeletal and Repetitive Stress Injury issues.
- A breath analyser would require a CE certificate and to bear the CE marking as having received 'European Conformity'. This means it complies to all the essential Health, Safety and Environmental requirements established by the European Standards Agencies.
- Any mouthpiece would have to be hygienic for the subject of the test, supplied in a sealed package and be disposable.
- A cheap disposable plastic straw type design, similar to that utilised in our existing breathalyser should be assessed primarily to avoid any un-necessary design time and expense.
- The product body would have to be resistant to disinfectant wipes and sprays.
- The product display would have to be resistant to disinfectant wipes and sprays.
- Electrical safety

2:29 Shelf Life & Storage -

- Management of incoming constituent parts, materials and finished stock should be kept to a workable minimum to reduce the risk of obsolescence before on sales.
- Logistics and Planning should confirm a realistic stock requirement that can be monitored and controlled easily.

2:30 Shipping -

- Is there a need for additional protective sleeves provision?
- What size is the immediate product packaging?
- How many of these boxes can be shipped in a bulk box?
- How many Bulk boxes can be safely assembled onto a pallet?
- Import or export issues should be investigated.,
- Import and Export duties should be investigated and costed?
- The provision of Customs brokers could be advantageous?
- The required documentation (such as customs documents) should be investigated.

2:31 Size –

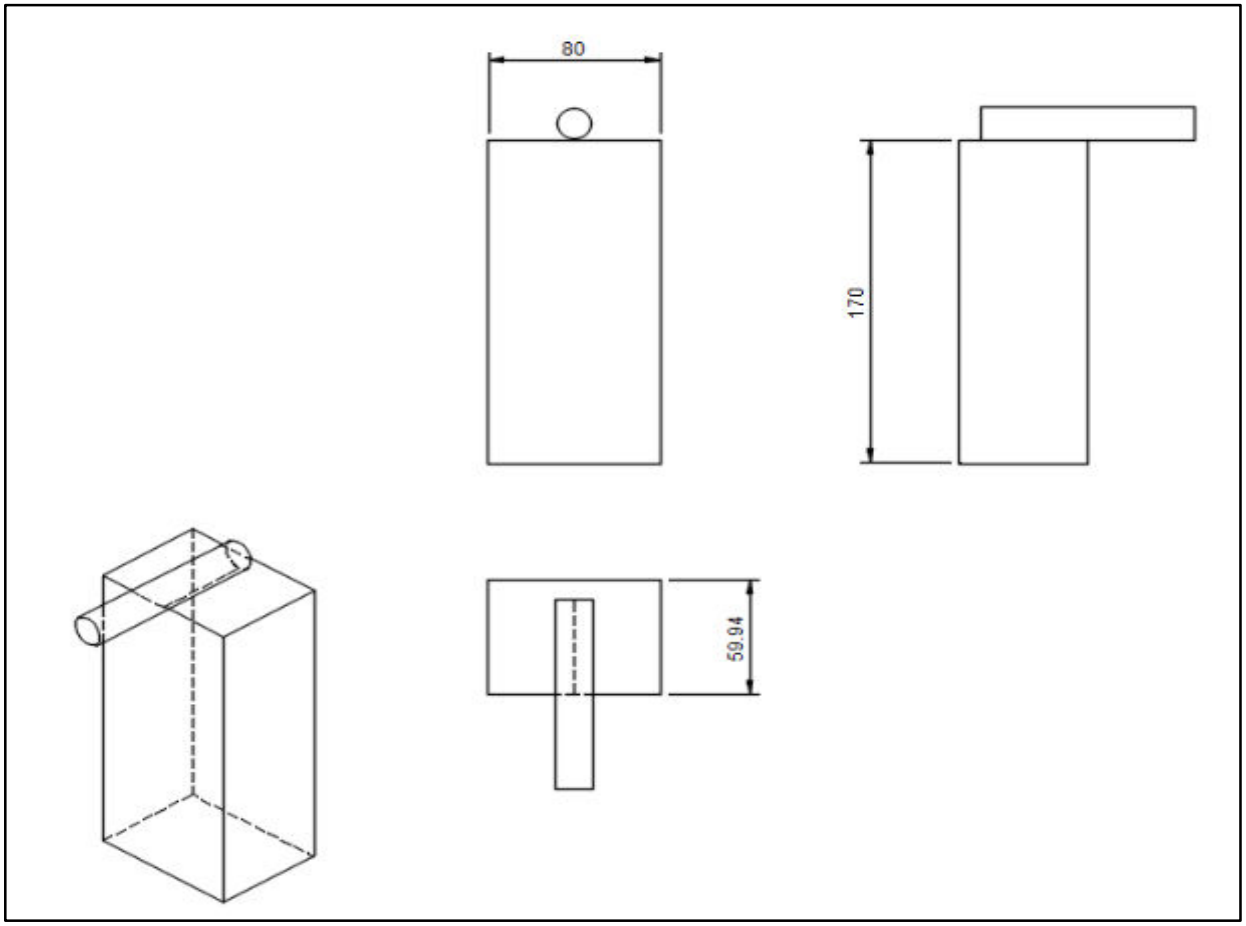
- The average male hand can quite easily hold a 100mm width item without straining.
- The average female hand can quite easily hold an 80mm width item without straining.

(Both of the above values were attained by our University research partners using a batch of volunteers in a controlled study.)

- An item designed within the envelope of circa 170mm (Height) x 80mm (Width) x 60mm (Depth) maximum should be aimed for.

This would allow it to be hand-held.

Sketch of defined concept dimensions



2:32 Social & Cultural -

- Checks should be made with major export cultures and languages so offensive terms or symbolisms are not unintentionally included.
- The product, the packaging and the instructions should all be proof checked with this in mind.
- A quick and reliable test to achieve safe audiences at concerts and hospitality event that minimises disruption to audiences wishing to gain entry.
- A quick and reliable test to achieve safe access for those wishing to gain entry to visit at risk family and loved ones in hospital or care homes.

2:33 Standards & Specifications -

- CE – European legislation
- BS EN – British Standards legislation
- RoHS – Health and Safety
- Government and Home Office
- Records of revisions to design, processes and inspection /testing.
- Internal quality records to be kept for 10 years? In case of warranty requirement.
- End of life directives?

2:34 Supply Chain -

- Is there an advantage to having a localised supply chain?
- Can advantages be extracted through sourcing from cheaper supply markets such as China and the Far East?
- Does shipping of parts from other countries cancel out or outweigh any advantage that might be gained through the reduced prices and overheads from overseas?

2:35 Testing -

The ideal method of in process testing would be an in-built Poke Yoke system integrated into relevant sections of the assembly operations and at the end of line.

Other pertinent testing would have to be assessed and those requirements accommodated.

- Extremes of temperature,
- Drop Testing,
- Dust proofing,
- Waterproofing,
- Connectivity range,
- Etc.

2:36 Time Scales -

- A primary a project timing plan to outline the schedule of activities and milestones required to deliver on time.
- There may be an opportunity that requires a fixed timeline to bring thee product to market, by way of example, the recent pandemic where sales could be maximised.
- This is also a useful tool to plan contingencies and rescheduling of tasks.
- A both realistic and achievable 'Tact time' for each operation should be determined and this should be communicated through adequate Work Instruction provision, training and operator consultation.
- A feedback loop should be put in place to confirm that the costed parameters are either achieved, bettered or unachievable for future costing reference.

2:37 Weight -

- Our aim should be to produce a device that is light and portable.
- That will allow the customer to easily keep it about their person along with prolonged hand-held use that will not result in any Muscular-skeletal or Repetitive Strain Injury concerns.
- A weight of circa 0.5 Kgs should be aimed for to achieve this.

(The value above was attained by our University research partners using a batch of volunteers in a controlled study.)

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