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How Will Robocop Communicate?

The design of a conceptual portable radio communication product for the NZ Police in 2018

Frazer D Ellis © - 2008 - Massey University College of Creative Arts

Abstract

This Master of Design study aims to communicate affective design principles within a Tait Electronics Ltd hand-held radio for the New Zealand Police to use in the year 2018. This investigation has three distinct research aims:

- A)** Identify affective design principles appropriate for the design of current Tait portable police radios using the perceptual product experience (PPE) framework (Warell, 2008).
- B)** Use speculative scenario planning to develop an understanding of how the requirements of Tait's portable police radios will evolve over the next 10 years.
- C)** Incorporate affective design principles and the brand values of Tait's product range into a final conceptual portable police radio design for the year 2018.

A comprehensive review of contemporary affective product design theory, case studies and other relevant literature was undertaken. This included affective product design (Warell, 2008), radio communication (Marzano, 2005) and future product forecasting (Lambourne, Feiz, & Rigot, 1997). Following this review the following research methods were selected for this study:

- 1)** Future scenario planning
- 2)** Current product-user interviews
- 3)** Passive product observations

Throughout the project iterative design methods were used, including 2D concept generation, concept development and 3D prototyping. The resulting conceptual product and associated documentation of this study will add to the existing body of knowledge around the application of affective design principles and portable police radio product design.

Keywords: radio, NZ Police, usability, performance, experience, perceptual product experience (PPE), affective product design

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1.0 - Background to study

Affect, the Centre for Affective Design Research, is a design research centre at Massey University's College of Creative Arts located in Wellington, New Zealand. Established in 2005, the research centre was created to increase knowledge and industry understanding of affective product design and its benefits.

In the interests of promoting affective product design and development to New Zealand industry the Growth and Innovation Pilot Initiative (GIPI) programme was initiated. As part of the GIPI programme three Masters of Design research projects were sponsored, involving the following companies:

- Fisher & Paykel Appliances
- Gallagher Animal Management
- Tait Electronics Ltd

This Masters of Design study is part of this research programme, working in collaboration with Tait Electronics Ltd, Christchurch, New Zealand.

1.1 - Research Aim

The aim of this investigation is to produce a Tait branded future portable communication product for the NZ Police force of 2018 that focuses on the end user, by applying affective product design principles and imperatives determined through this study. This investigation has three research aims:

- A)** Identify the affective product design principles appropriate for the design of current Tait portable police radios using the perceptual product experience (PPE) framework (Warell, 2008).
- B)** Use speculative scenario planning to develop an understanding of how the requirements of Tait's portable police radios will evolve over the next 10 years.
- C)** Incorporate affective product design principles and the brand values of Tait's product range determined through this study into a finalised conceptual portable police radio design for the year 2018.

1.2 - Research Objectives

Objective 1

Determine how the application of affective product design principles can improve the experience of future Tait portable police radio designs.

Objective 2

Determine how emerging trends in technology and consumer products may affect future New Zealand Police hand-held radio design

Objective 3

Design a prototype for the New Zealand Police force for the year 2018 that displays the affective design aspects determined from the study's previous objectives.

Objective 4

Document/communicate the project's findings in a suitable format for the New Zealand Police, Tait Electronics Ltd and Affect, the Centre for Affective Design Research.

1.3 - Research Questions

Research Question 1

What is the current state-of-the-art in portable police radio product design?

Research Question 2

What current or future technologies have potential for use by the New Zealand Police?

Research Question 3

How may current consumer products influence the design of future portable police radios?

Research Question 4

What are the most important affective product design qualities associated with the design and development of a current Tait portable police radio?

Research Question 5

What are the design characteristics that determine a Tait Electronics Ltd product?

Research Question 6

What are the most important affective product design qualities for a current portable police radio as determined by the user (the NZ Police)?

Research Question 7

How are contemporary portable police radios used?

Research Question 8

What are the requirements and desires of contemporary New Zealand Police portable radio users?

2.0 - Project Scope

This section outlines the scope of this investigation., including participants and technological basis.

2.1 - Affect - Research Centre

Established in 2005, Affect, the Centre for Affective Product Design, is a design research centre of Massey University's College of Creative Arts located in Wellington, New Zealand. To increase New Zealand industry knowledge and understanding of affective product design the Growth and Innovation Pilot Initiative programme (GIPI) was initiated. The mission statement for Affect is:

“To increase knowledge in affective design through practice and to transfer this knowledge to industry, the research community, and tertiary education” (Affect, 2008)

Affect is a project partner in this investigation, and its affective design principles informed the research approach.

2.2 - Tait Electronics Ltd

Tait Electronics Ltd (Tait) is a New Zealand based manufacturer of radio communication products. Tait are considered a world leader in radio communication product design and innovation with a strong focus on the robustness and reliability of their products. Tait Electronics Ltd is a project partner in this investigation. This research is being undertaken with cooperation and insight from the research and development team at Tait, and the final conceptual design will embody the Tait brand values (as defined in this investigation).

2.3 - New Zealand Police, NGĀ PIRIHIMANA O AOTEAROA

The New Zealand Police, Ngā Pirihimana O Aotearoa (NZ Police) is the national police force of the sovereign state of New Zealand and its territories. NZ Police responsibilities are:

- Enforcing criminal and traffic law
- Enhancing public safety
- Maintaining peace and order through New Zealand's territories

(New Zealand Police, 2009). The NZ Police are the target users of the final radio concept, and this investigation has been conducted with their cooperation.



Figure 2.1 - Affect Research Centre Logo, (2008). Source: Affect Website



Figure 2.2 - NZ Police Logo, (2008). Source: NZ Police Website



Figure 2.3 - Tait Logo, (2008). Source: Tait Electronics Website

2.4 - Radio Communication

Radio communication is the transmission of signals from one device to another, either point-to-point radio communication (see figure 2.4) or point-to-multi-point (see figure 2.5). Portable or 'hand-held' police radios were first used by the British national police force in 1969. Since then it has become an established communication tool for national police forces around the world, including the NZ Police. Radio communication is the fundamental technology underlying this investigation.

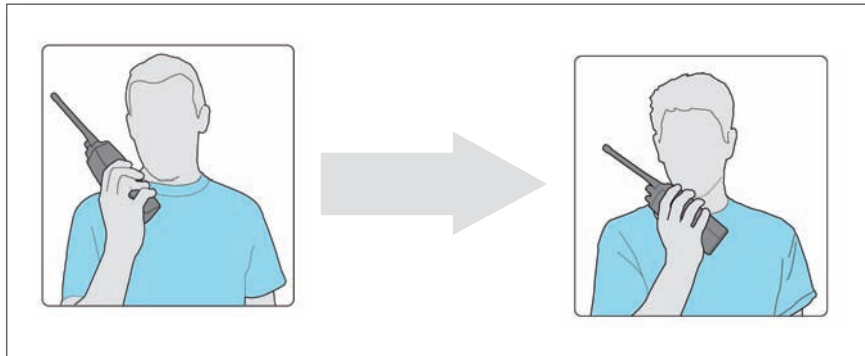


Figure 2.4 Point-to-point communication

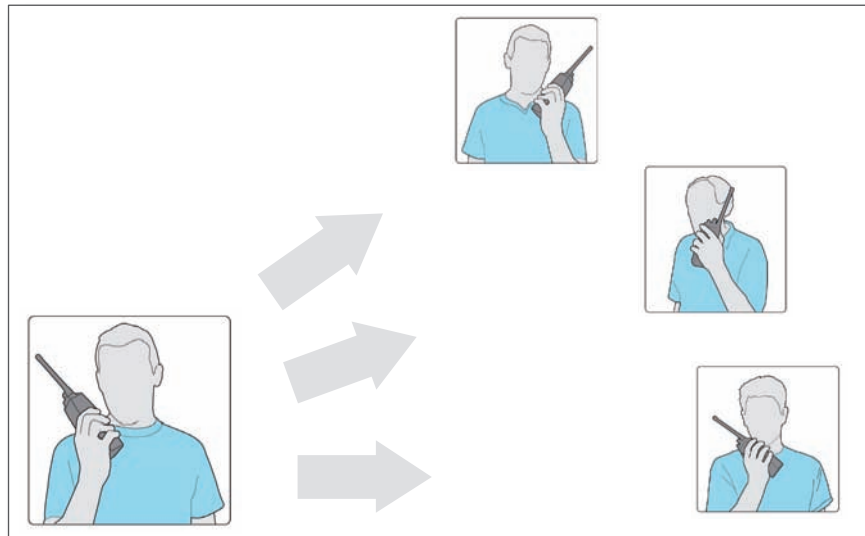


Figure 2.5 Point-to-Multi-point

3.0 - Background Research

This section aims to establish a general understanding of affective design theory and how it is used within this investigation, the selection of the product forecasting techniques(s) used in this study and current police radio design.

3.1 - Affective Design Theory

The focus of this investigation is not to determine what affective design is. Instead, it is an exploration into how affective product design principles can be applied to the product area of this study (futuristic portable police radio). The aim of this section is to determine an appropriate theoretical framework for identifying the product experience of police portable radios.

Norman (2004), Heufner (2004) and Warell (2008) have created various frameworks and methods of identifying how a product is experienced. Their work is examined and discussed in this section.

3.1.1- Affective Design Theory

A recent trend in product design research has been to focus on how a product is experienced in addition to its functions and its efficiency. Through cognitive, affective and sensory stimulation, we experience a product. Several authors have deconstructed the product experience through application of their own design frameworks.

Norman (2004) proposes three 'aspects of emotional design': visceral design, which is concerned with the look and appearance of the product; behavioural design, which pertains to the effectiveness of its use and pleasure; and reflective design, which considers the reputation, rationalisation and intellectualisation of the design (see figure 3.1).

Heufner (2004) suggests there are three distinct levels of the design experience. The 'observer level' is concerned with the aesthetic functionality of a product based on the experience of the five senses (sight, smell, hearing, touch and taste). The 'user level' is concerned with the practical functions, based on the physical experience. The 'owner level' relates to the symbolic value of a design through social experience

While the frameworks of Norman and Heufner provide broad parameters for understanding the product experience, for the purposes of this investigation a more refined and detailed framework is needed that can provide multiple options for interpreting how a product is perceived.

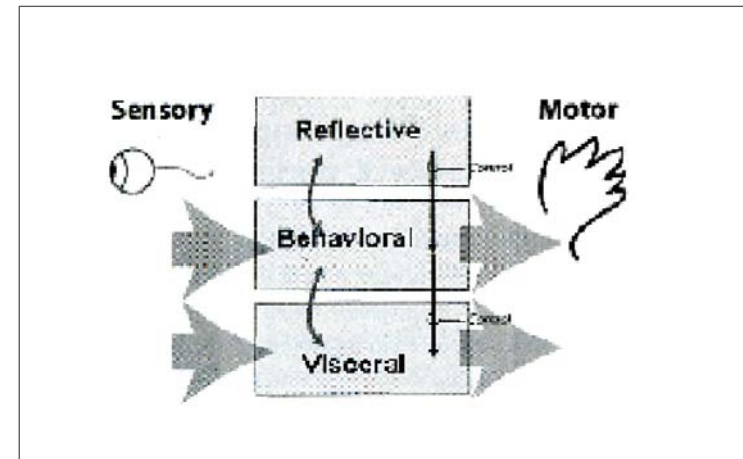
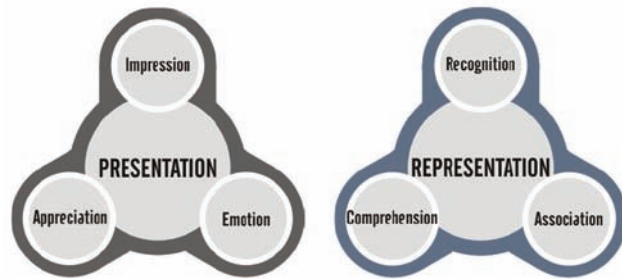


Figure 3.1 - The Three Levels of Emotional Design, (Norman, 2004a,p22).

3.1.2 - Warell's Perceptual Product Experience Framework



The PPE helps do the following:

- Understand possible experiences
- Map, categorise and analyse experiences
- Predict possible experiences
- Specify experiential aspects
- Compare brand specific perceptions
- Compare cross brand experiences
- Compare cross cultural/market experiences
- Develop and evaluate experiences

Warell's (2008) framework of perceptual product experience (PPE) offers a holistic understanding of how a product is experienced. The aim of the framework is to provide a structured way of thinking about the 'nature' of a product experience that is relevant to the design of the product. The PPE focuses on

“the perceived, non-instrumental aspects of product interaction – how users, customers, or colloquial observers experience the product based on what is observed, judged, and inferred from the product manifestation; its sensory appearance” (Warell, 2008).

Figures 3.3 and 3.4 show the design of the Presentation and Representation modes of the PPE framework.

These modes of operation do not operate independently; instead, both modes are interdependent. The PPE framework (Warell, 2008) can be used to define the product experience. What it does not address is the practical and instrumental aspects of a product's design. Therefore this study will employ the PPE framework in conjunction with other research methods that explicitly address the goal-orientated functions and usability issues in relation to the user-product experience.

Figure 3.2: PPE framework (Warell, 2008)

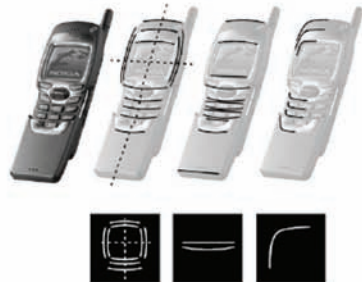
Presentation Mode

Presentation

The pleasurable experience

Sensory **Perception and Understanding**

Sensuous **pleasure and delight**



Appreciation

“What people ‘like’”

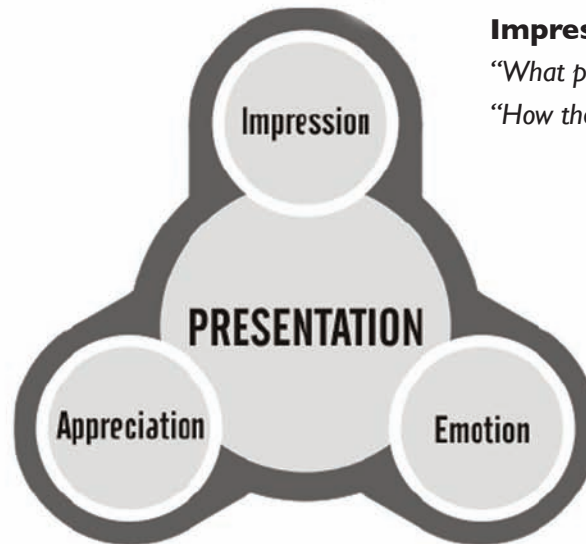
“How the product appeals”



Impression

“What people ‘notice’”

“How the product stands out”



Emotion

“What people ‘feel’”

“What emotions the product elicits”

Figure 3.3: PPE - Presentation Mode, (Warell, 2008)

Representation Mode

Representation

The meaningful experience

The product interpreted as a **message**

The product read 'as a **sign**'



Recognition

"What people are reminded of"

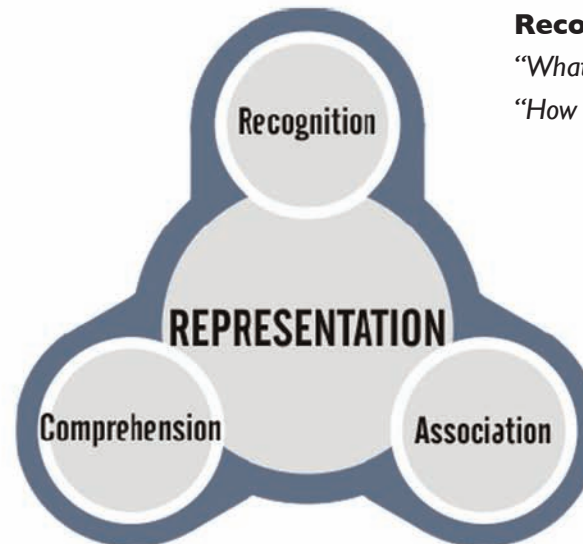
"How the product is (like)"



Comprehension

"What people understand"

"How the product is"



Association

"What people think of"

"What the product stands for"

Figure 3.4: PPE - Representation Mode, (Warell, 2008)

3.2 - Product Forecasting

This section determines appropriate method(s) for forecasting a future portable police radio.

3.2.1 - Product Forecasting Discussion

Social Trends and Product opportunities: Philips Visions of the future project (Lambourne et al., 1997) was an investigation undertaken by Philips design in the year 1996. The aim of this project was to explore future product concepts for the year 2005. Although this project does not directly investigate the design of future police portable radios, it does demonstrate how a major company approaches forecasting products for the future.

The Ultra Mobile Personal Computer vision of the future (IDEO, 2007) is a series of short films released by Intel Corporation. They do not contain a suitable forecasting research process; however, these short films focus on forecasted communication product concepts. They also exemplify the effective use of film media to communicate a product's functionality, context of use and product aesthetic design (see figure 3.5).

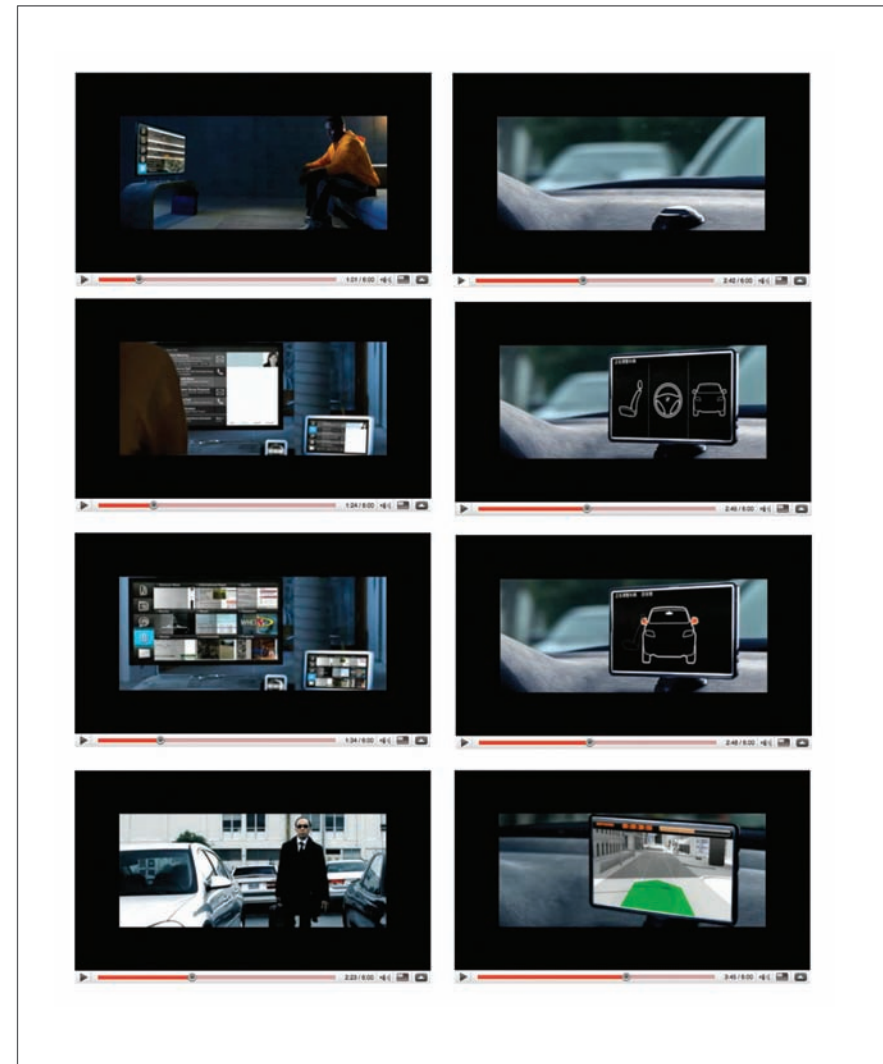


Figure 3.5: Mobility platform videos for Intel, (IDEO, 2007)

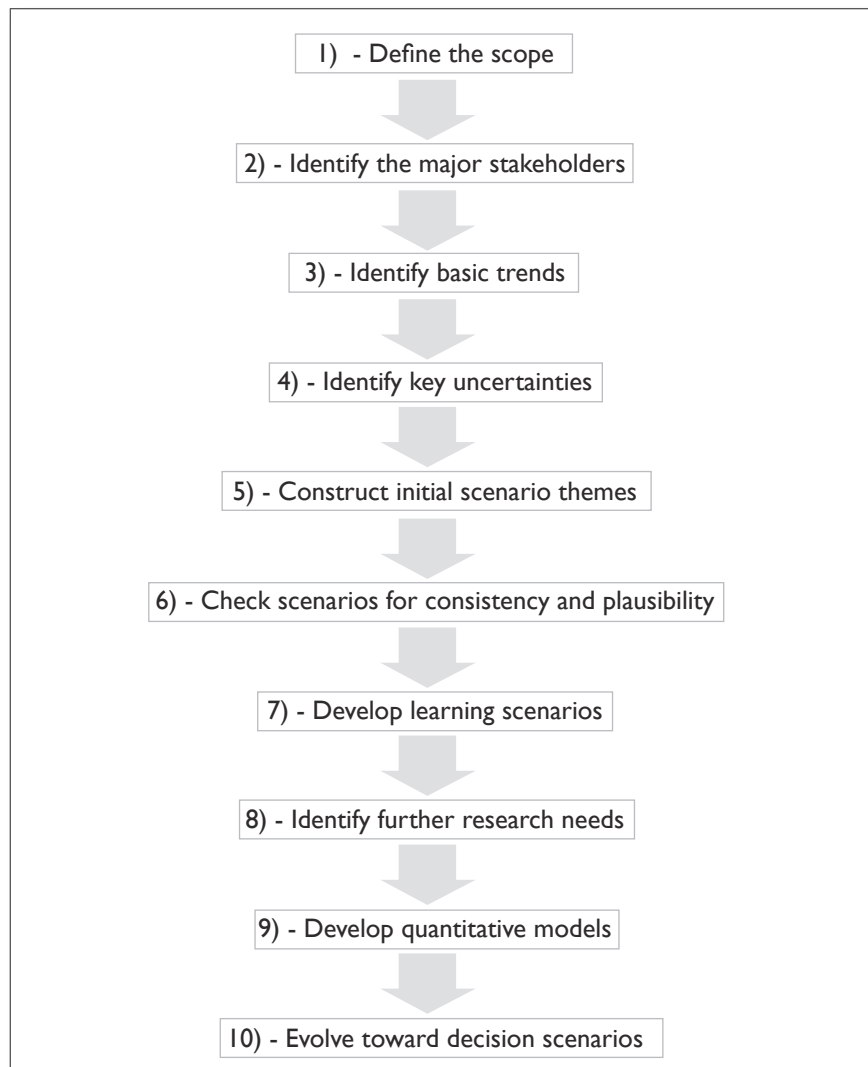


Figure: 3.6 Scenario Forecasting Checklist, (Schoemaker, 1995)

3.2.2 - Scenario Planning

Schoemaker (1995) describes a forecasting process commonly used by companies and design houses alike to explore future possibilities for their business or product(s), through the development of potential future scenarios. To construct these scenarios the process consists of a ten-step checklist (see figure 3.6).

This process focuses on creating a series of business models as learning scenarios which are used as strategic management and decision making tools.

For the purpose of this study relevant aspects of the scenario planning process have been used. Stages 3 to 7 of the scenario planning method provided four separate forecasted scenarios from which concept products can be created.

3.3 - Current Police Portable Radio Design

This section outlines the following:

- Police radio system design
- Radio assignment
- Current product architecture
- Product variations
- Radio batteries and chargers
- Police radio accessories
- Current police radio product market
- State-of-the-art police radio
- Police radio design case study

3.3.1 - Police Radio System Design

Three New Zealand government agencies - the NZ Fire Service, NZ Ambulance Services and the NZ Police - have the option to use these standard operating systems: APCO Project 16 (Association of Public-Safety Communications Officials International), TETRA (TERrestrial TRunked RAdio, formerly known as Trans European Trunked RAdio) and APCO Project 25 (Association of Public-Safety Communications Officials International). The key features of these operating systems include:

- Point to multipoint communication (different to cell phones which are point to point communications) (see figures 2.4 and 2.5)
- PTT (Push-to-talk); a single button press opens a outwards communication channel
- Closed user groups: unauthorised radios are not able to join the encrypted network

Project 16 (APCO) is an analogue based system design with no encryption capabilities. Encryption offers increased security and privacy of communications as well as the ability to send and receive text messages. TETRA and Project 25 (APCO) are both digitally encrypted systems. Due to the cost effectiveness and high standard of performance Project 16 analogue system designs are still in widespread use in both New Zealand and around the world.

3.3.2 - Radio Assignment

There are two potential options for providing police officers with portable radio equipment:

A) - 'Group Issue'

Radios are communally issued. At the start of a shift the officers are equipped with a portable radio, the desired accessories and a replenished battery. At the end of the shift the radio, accessories and spent battery are returned to the station.

B) - 'Personal Issue'

Radios are individually issued to officers for a pre-determined time period, for example 6 months. The officer is personally responsible and therefore accountable for the radio; this includes upkeep and management of the radio, its accessories and batteries.

Generally the choice as to which radio assignment option is used by a police force is a monetary decision. If radios are personally issued the cost is high because each officer is assigned a radio, however due to the psychology of ownership the radios are treated with more care and respect. The advantage of group issued radios is the tactical implications; radios can be reassigned according to demand. It is also noted that (depending on the radio's design) personal issue radios can be personalized according to the user's desires.

3.3.3 - Current Product Architecture

To define the current product architecture this section has been divided into three categories:

Physical interface

- 01 - Volume/power knob
- 02 - Channel knob
- 03 - Zone selector
- 04 - Emergency button
- 05 - PTT
- 06 - Programmable buttons
- 07 - Navigational keypad
- 08 - Alphanumeric keypad

Display

- 09 - Display screen
- 10 - Display-screen lighting
- 11 - Pilot light

Physical product design

- 12 - Antenna
- 13 - Built-in speaker/microphone
- 14 - Branding label
- 15 - Accessory connector
- 16 - Battery catch
- 17 - Battery
- 18 - Belt clip slot

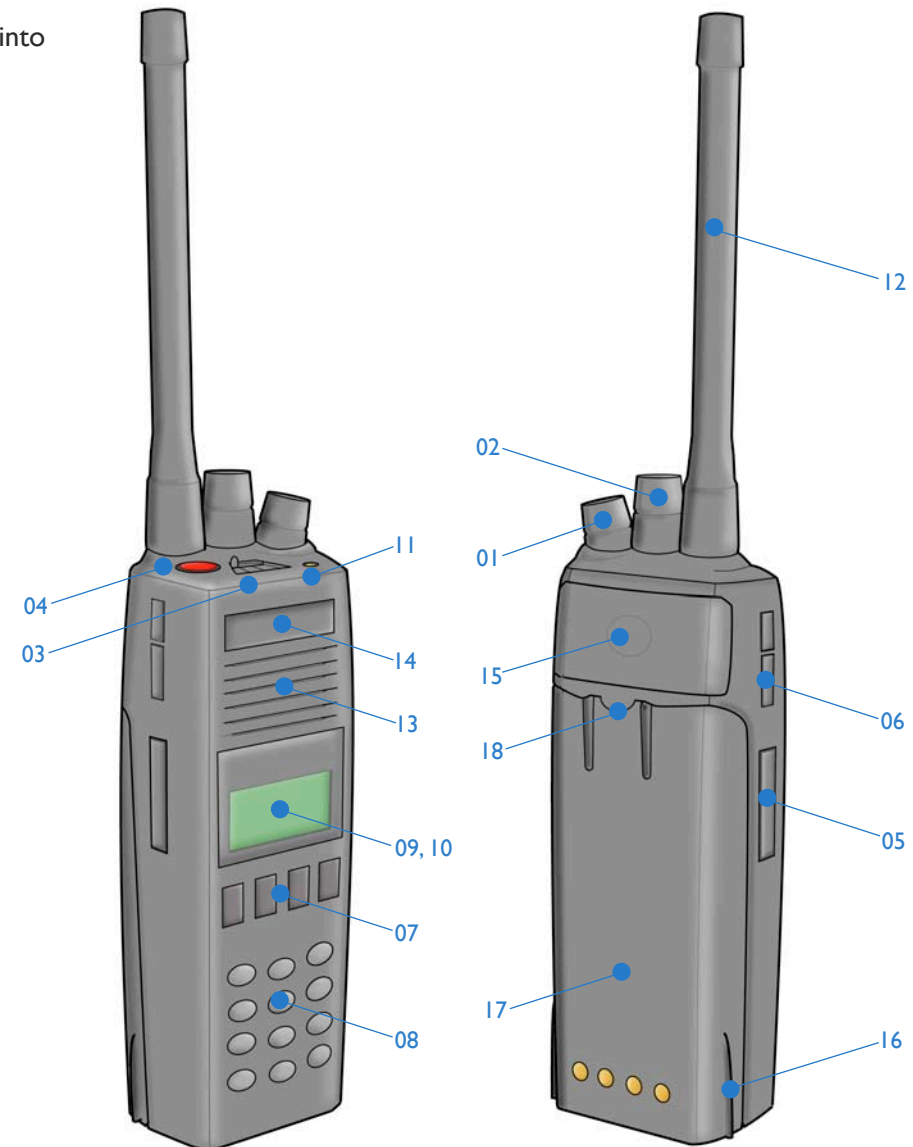


Figure 3.7: Project Generic product architecture

01 - Volume / power knob

Turning this knob:

- A) Activates/deactivates the radio (see Figure 3.8)
- B) Adjusts the volume (see Figure 3.8)

02 - Channel knob

Turning this knob changes the channel selection. This is conventionally located top centre of the radio to prevent accidental operation (see Figure 3.8).

03 - Zone selector

Operation of this shift-knob changes the zone selection and provides additional channel capability (see Figure 3.8).

04 - Emergency button

Once activated the emergency button jams the user's communication channel open for ten seconds, then off for ten seconds, and then jams the channel open for a further ten seconds. The rationale behind this function is to allow the users to identify him/herself, and their situation and location, during the allotted ten seconds of open communication (see Figure 3.8).

Due to the high-risk nature of a police officer's job an emergency button has been established as a design requirement for police radios (see Figure 3.8).

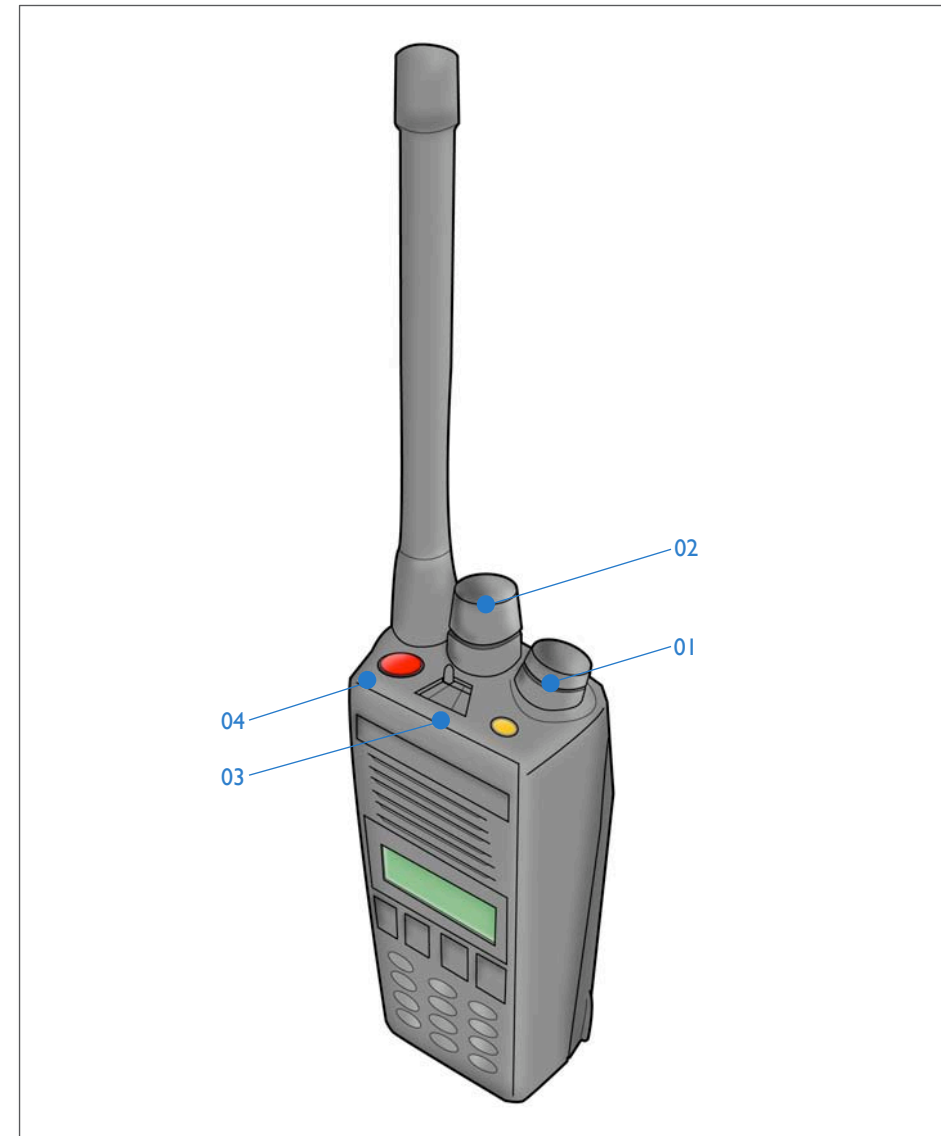


Figure 3.8: Generic product architecture - Top view

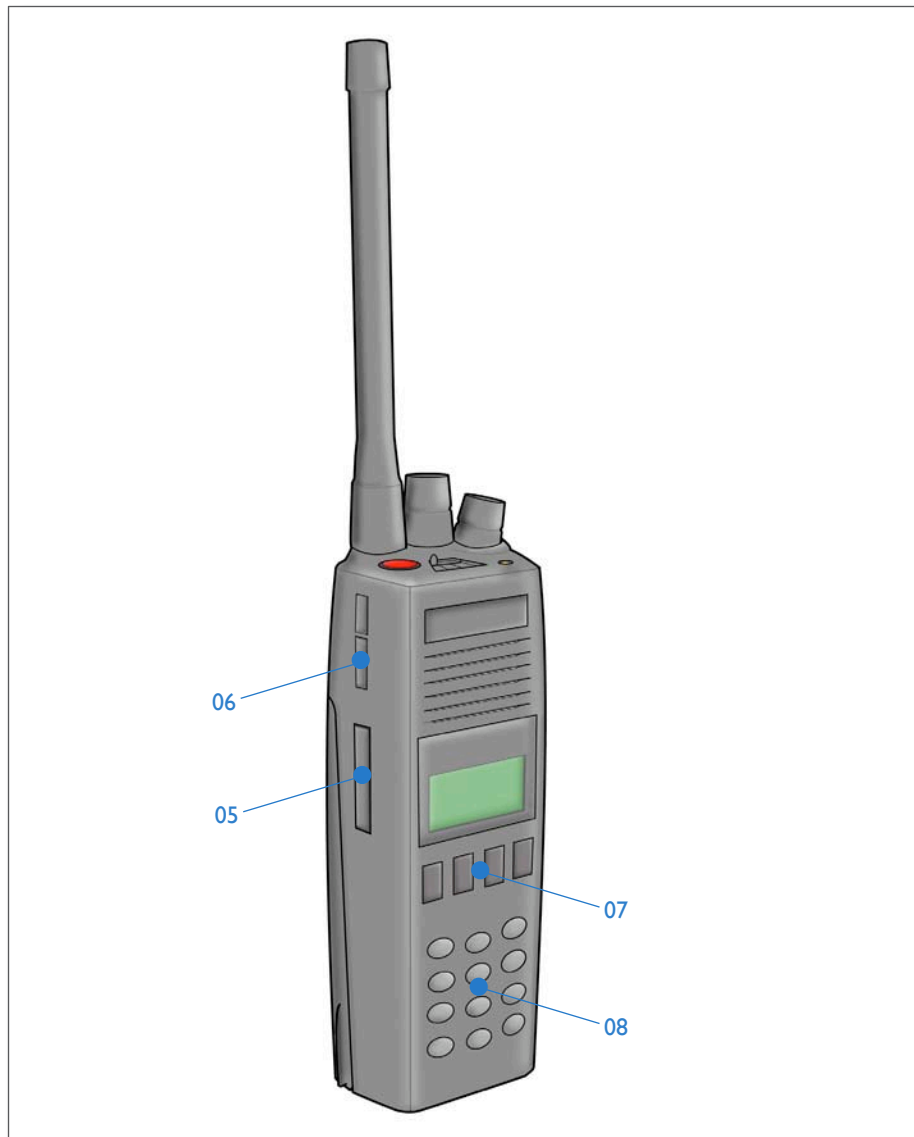


Figure 3.9: Generic product architecture - Single side

05 - PTT (Push-to-talk)

Release to listen; a single button press opens a communication channel. PPT buttons (also known as 'press-to-transmit') are used for conversing between other portable radios or base stations in the same network (see Figure 3.9).

06 - Programmable buttons

Programmable buttons are designed to give additional functionality and flexibility to portable radios. These buttons are required to be pre-programmed at the factory and cannot be altered unless returned to the manufacturer (see Figure 3.9).

07 - Navigational keypad

The navigational keypad is used for basic interaction and navigation of the display screen (see Figure 3.9).

08 - Alphanumeric keypad

The alphanumeric keypad affords the ability to dial numbers and input text. It consists of a standard 12 button, phone style keypad (see Figure 3.9).

09 - Display screen

The display screen is used to present the following information:

- Battery level status
 - Channel selection
 - Zone selection
 - Network status
 - Network reception
- (see Figure 3.10)

10 - Display-screen lighting

The screen illuminates when operating the navigational or alphanumeric keypads. The colour of the display screen varies according to brand. Most radio manufacturers offer a radio with a standard interface screen colour. These colours include green, red and blue (see Figure 3.10).

11 - Pilot light

The pilot light is a red flashing light that is programmed to flash during pre-set intervals of between 2-5 seconds. This varies between radio manufacturing brands and radio configurations (see Figure 3.10). This light is used to show the radio is functioning.

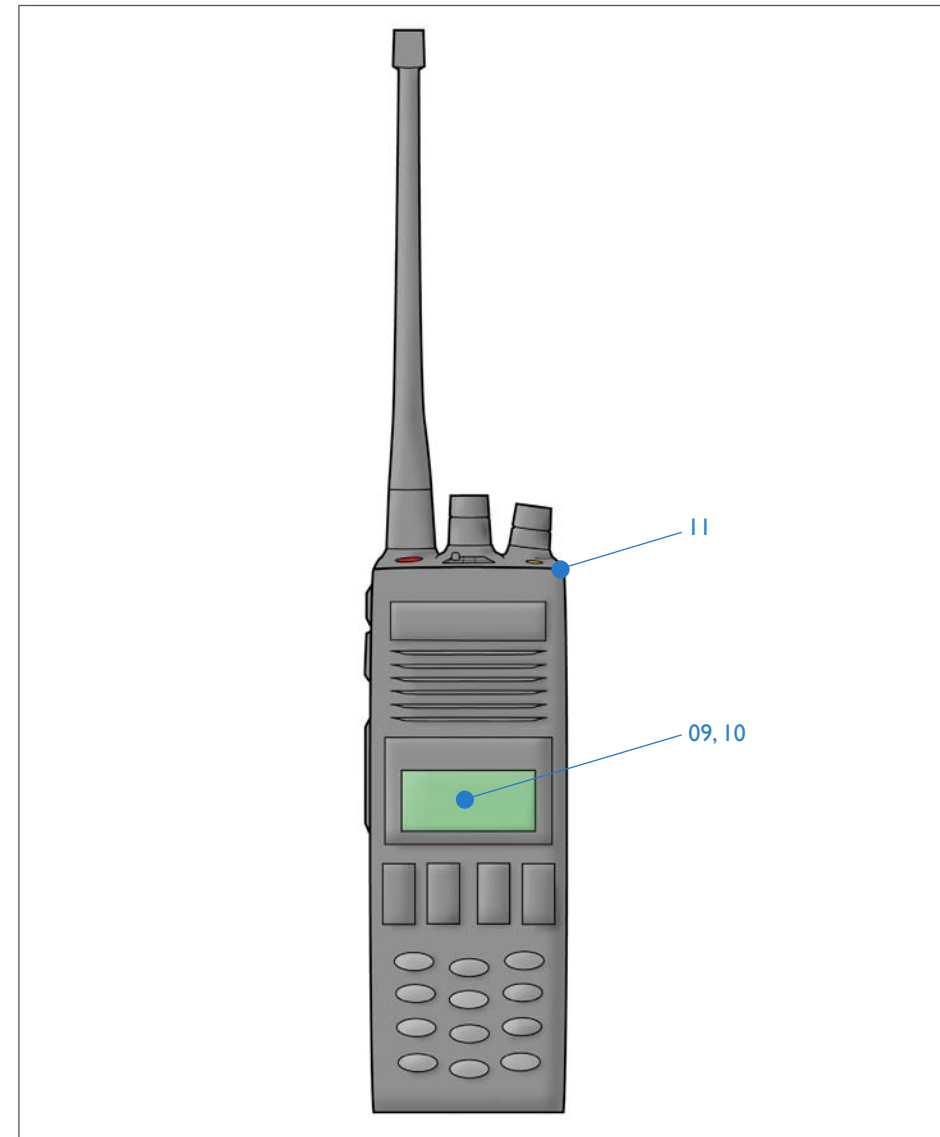


Figure 3.10: Generic product architecture - Front view

Physical Product Design

I2 - Antenna

The antenna is a component required for the functioning of the radio. The variations in antenna designs are due to various system requirements. Different antennas provide range and frequency levels of communication (see figure 3.11).

I3 - Built-in speaker/microphone

Audio input and output for the radio (see Figure 3.11).

I4 - Branding label

Can be located at any location on the radio. The usual information that is branded on radios is the manufacturer's logo and the model type (see Figure 3.11).

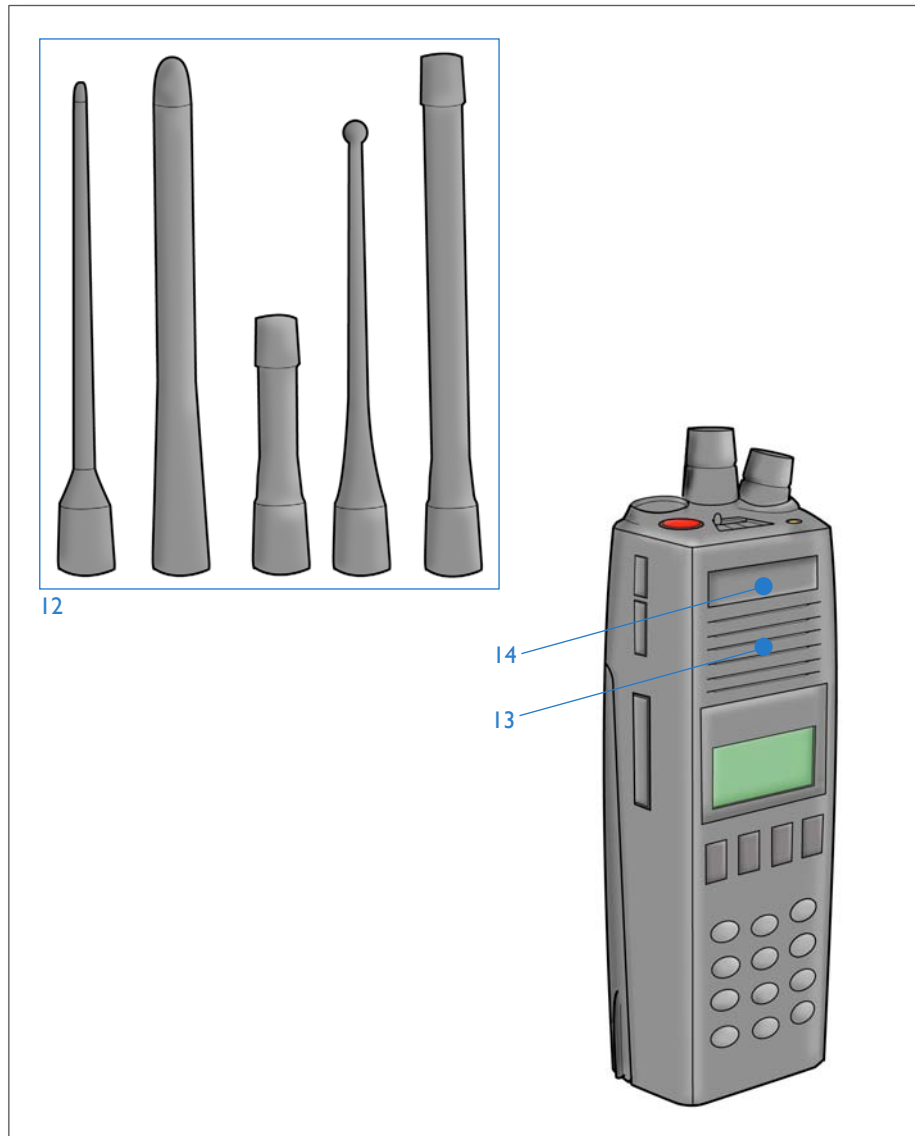


Figure 3.11: Generic product architecture - Antennas

15 - Accessory connector

This is a standardised attachment port where accessories such as speaker/microphones and hands-free sets can be connected. A current design convention is for the accessory connector to be located at the top rear of the radio (see Figure 3.12).

16 - Battery catch

The battery catch holds the battery in place and allows it to be removed when desired (see Figure 3.12).

The battery is designed with two locating ridges on either side of the battery; these are in place to help locate the battery in the battery charger, either independently or when attached to the main radio unit.

17 - Battery

Provides the power source for the radio. Radios are currently issued with two batteries: One battery is in-use, while the other is charged. Contemporary battery technology means that radios have a stand-by operation time of 24 hours, and a full-use operating time of 13 hours (see Figure 3.12).

18 - Belt clip slot

The belt clip allows for the attachment of the radio to a belt or load bearing harness (see Figure 3.12).

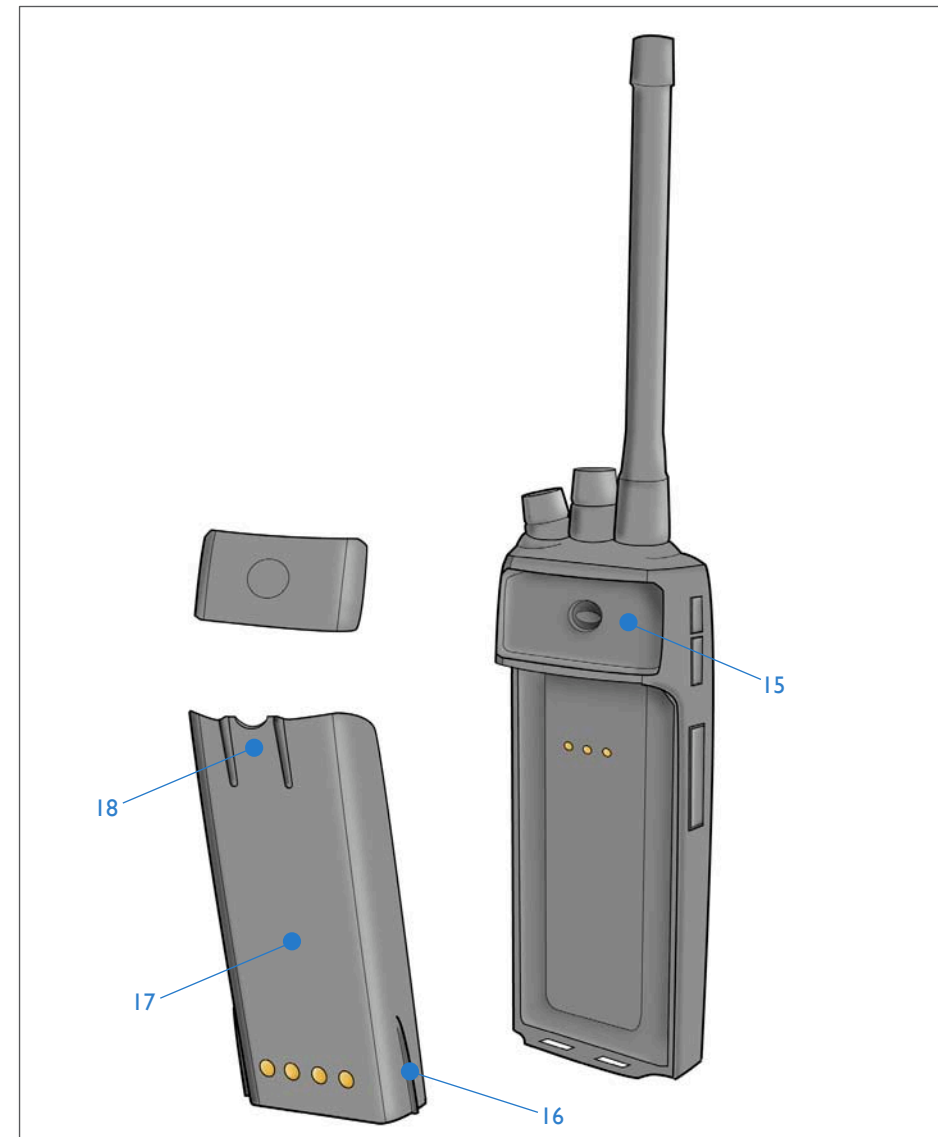


Figure 3.12: Generic product architecture - Rear view

3.3.4 - Product Variations

Portable police radios are available in two basic model constructs:

- 1) This model has a navigational keypad (4 keys), a display screen and a moderate complement of zone and channel ability (see figure 3.13-1).
- 2) This model has a navigational keypad (4 keys) along with a full alphanumeric keypad, a display screen and full zone and channel ability (see figure 3.12-2).

The rationale behind these product variations is to provide cost options for purchasing radios. The number of product variations is not standardised between radio manufacturers. As mentioned in section 3.3.1, analogue radio systems are still in widespread use nationally and internationally. This is because of the associated costs of setting up a digital system network, which can prove to be a significant financial barrier.

Another deciding factor as to which product variation is used by a police force is that of radio ability. For example, the system design does not allow for any kind of text messaging so there is no requirement to have a radio with an alphanumeric keypad.

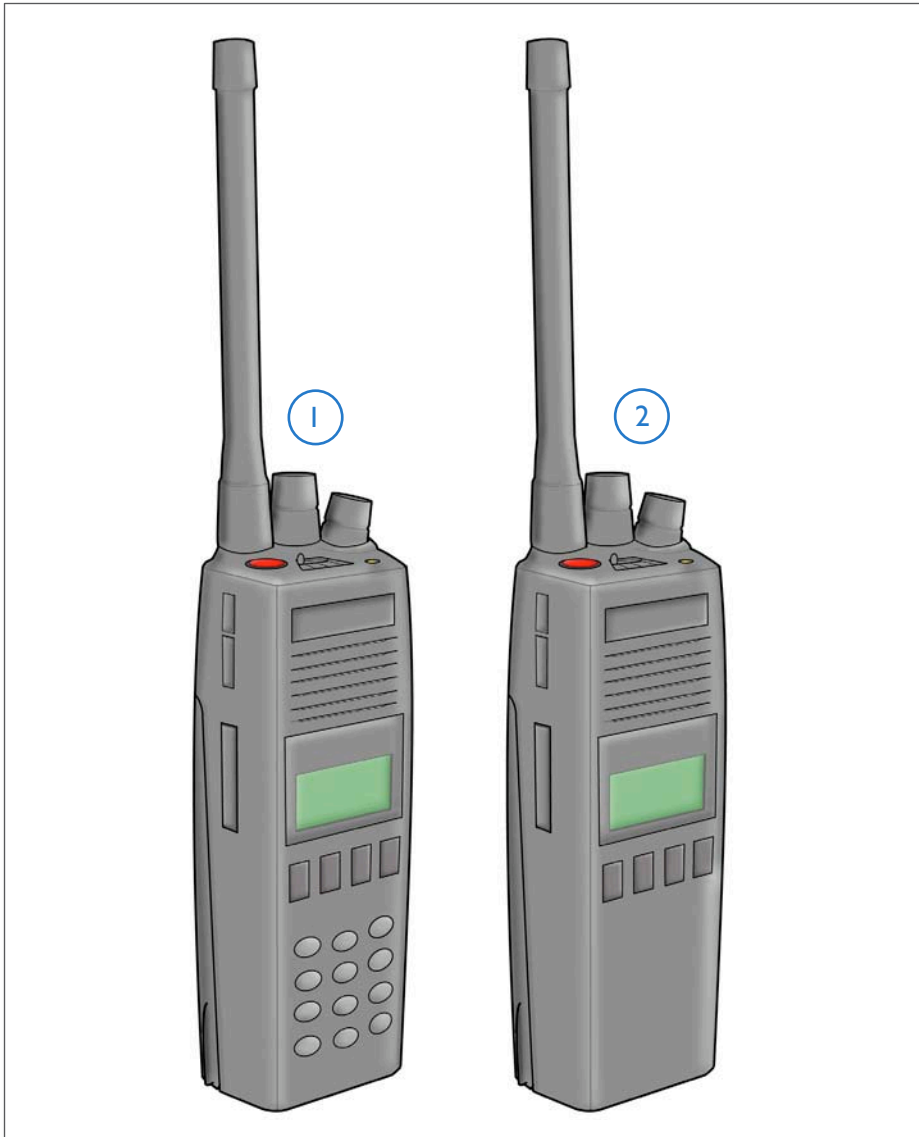


Figure 3.13: Generic product architecture - 1) - Full Keypad, 2) - Basic model

3.3.5 - Radio Batteries and Chargers

Radio chargers are available in two variations:

A) - Single-unit charger (see Figure 3.14-1)

B) - Multi-unit charger (see Figure 3.14-2)

Single-unit chargers are generally used in personal (see section 3.3.2) radio issue assignments, whereas multi-unit chargers are more suitable for use in the group issue (see section 3.3.2) assignments due to its efficiency of space and economy. In some scenarios single-unit chargers are mounted into vehicles.

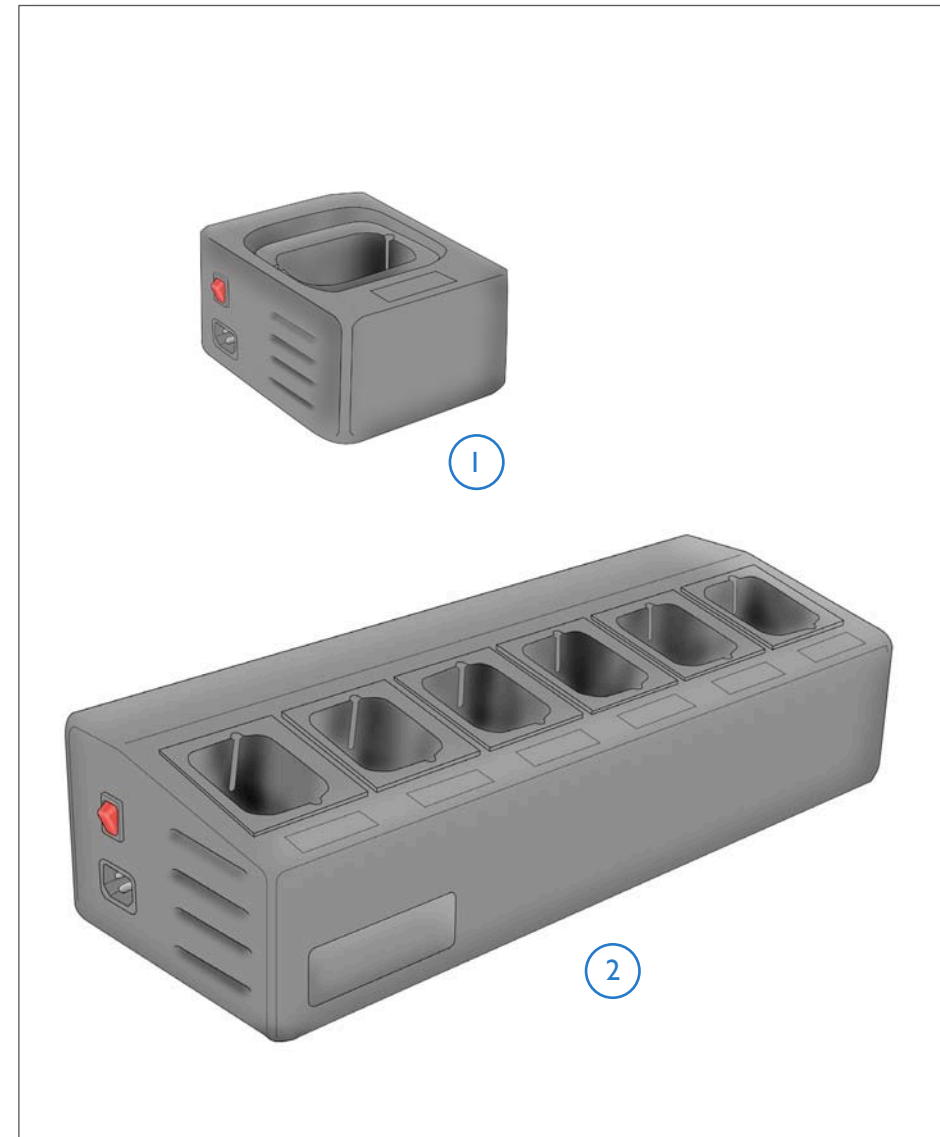


Figure 3.14: Generic battery chargers - 1) - Single 2) - Multiple

3.3.6 - Police Radio Accessories

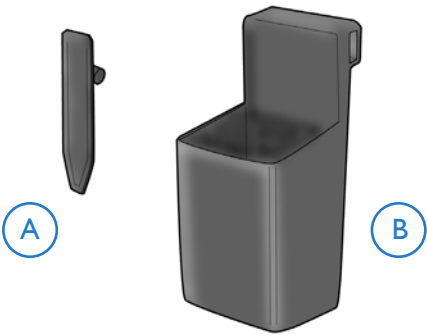
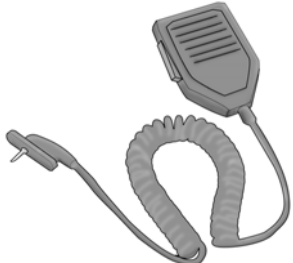
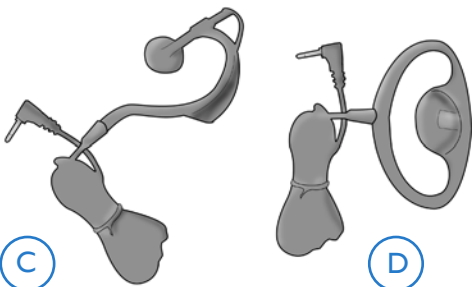
Accessory	Use	Description	Image
Radio holders A) Belt clip B) Radio holster	To transport hand-held radios, belt clips and holsters are used. Depending on the user's preference the radio is positioned at any location on the belt.	Belt clips are either spring loaded or non-spring loaded. They are usually designed individually for the radio unit, as opposed to belt holsters, which are designed to be a generic size that is used for a small range of similar radio designs. Belt holsters are generally made out of thick leather or a type of heavy-duty nylon.	
Speaker/microphone	Speaker/microphones are used to give users the ability to not have to remove the main radio unit from their belt holder/holster.	Speaker/microphones consist of an attachment plug, PPT (Push-to-talk) button and a microphone. Some newer models also have an emergency button built-in as part of the product design.	
Earpiece C) Earbud piece D) D-ring piece	Earpieces are used to increase the privacy of audio communications and to enable users to engage with the audio functions of the radio without having to remove the main radio unit from their belt holder/holster.	Earpieces are generally an issue of personal preference. Earpieces can range from a standard ear-bud, to a custom moulded ear bud. Other earpiece types include D-ring earpieces and transparent earpieces. These earpieces are used by police forces because they are ideal for covert operation.	

Table 3.1: Police Radio Accessories

3.3.7 - Current Police Radio Product Market

Figure 3.15 represents five example radios from the current market for police portable radios. Through analysis it was determined that the functionality and product design of each radio was the same (See section 3.3.3). Product branding and materiality are the differential features between each of the radios. The notable product brand differences were:

- Variations in product composition and proportions
- Use of textures on product form
- Size of control knobs
- Interface backlight colour
- Speaker/microphone cover pattern
- PPT (push-to-talk) configuration and composition
- Composition of navigational pad (four keys)
- Use of colour

The future radio is required to be Tait branded. The Tait brand is discussed and determined in section 6.2.3.



Figures 3.15: Current Police Radio Product Market



Figure 3.16: Motorola APX 7000 (Motorola, 2008)

3.3.8 - State-of-the-art Radio

The Motorola APX 7000 (see figure 3.16) is the first truly hybrid radio/cell phone police radio communication product available. This product is not going to be released to market until March of 2009, initially into the North American market, with the intention to expand into other markets in the future. The notable product features are:

Interface design features:

- GPS (global positioning service)
- Caller identification list
- 'Intelligent lighting' settings
(interface lighting adjusts according to spatial conditions)
- Colour display interface

Physical design features:

- Dual sided speaker/microphone design
- Increased access to control knobs through 'T-grip' design
- Top display-screen

This product highlights the design and integration of product features like GPS (global positioning service) and 'intelligent lighting' (screen lighting that adapts to spatial conditions) into a current portable radio design. The most endearing product feature is the use of colour in respect to the interface (full colour screen) and product aesthetic as well as the 'T-grip' design (increased product grip and increased space for operational knobs). The future radio design could incorporate the following product features:

- 'Intelligent lighting'
- Caller identification
- Colour display interface

3.3.9 - Police Radio Design Case Study

Portable radios are categorised as non-consumer products. This is due to the high standards of performance, non-consumer user group, and commercial sensitivity of the product. Because of this, the number of case studies freely available is minimal. Although dated, this case study of Philips Corporate Design’s design process investigation into a digital police portable radio (Marzano, 2005) is very relevant and salient for this project. The scope of the project was to design a new generation of portable police radios using digital technology.

According to this case study the most important requirements for a portable police radio are: reliability and robustness because of rough treatment, lightweight product design due to prolonged use by officers and the need for all communications to be private. Also discussed are potential additions to the product’s functions and design; these additions have been categorised into performance and experience (see table 3.2).

Although not explicitly presented as part of the document, it was discussed how the requirements of the user were ranked according to perceived importance. This was done to inform the product’s physical and system design. For example, the volume knob is used the most while the channel knob is only used occasionally.

Experience <ul style="list-style-type: none">- Conservative nature of the target user group- Need for the product to have differentiation in its aesthetic design (because it is a new product)- Connects officer to a community (other officers on duty)
Performance <ul style="list-style-type: none">- Transferring data via the digital system, to separate emergency services (for example, medical data to ambulance staff)- Transferring suspect biometric information (in this case fingerprints or photos) of a suspect to Comms (Marzano, 2005)- Ground plans / maps- Remote access to police databases- Memo recorder

Table 3.2: Performance and Experience Attributes



Figure 3.17: Product Form Studies (Marzano, 2005)



Figure 3.18: Refined Product Form Studies (Marzano, 2005)

The most prevalent question asked was “should the product look like a cellular telephone or a walkie-talkie?” To investigate this, the three product form studies were designed to represent the following looks:

- A)** - Cellular phone in styling
- B)** - Utilitarian/military in styling
- C)** - ‘Consumer-ish’ / in between products A and B

These three form studies were then analysed by a sample user group, and the feedback from them used to inform the development of three refined hard models. These more refined three concept models were then shown to another sample user group for feedback. The user group were asked to determine which of the concepts would be most appropriate for their needs. The results were favourable for a product that is styled between concepts A and B (see figure 3.17).

The insight gained from this study all pertains to the user requirements and desires of emergency service staff in the United Kingdom; however, it can be perceived that the needs of the NZ Police are similar to those of their European counterparts. The most relevant insight gained was the need for a research and design process that will help decipher the most appropriate aesthetic for a portable police radio, as well as the required and desirable functions for a future radio design.

3.4 - Secondary Research Summary

Through an evaluation of several frameworks for understanding the product experience, the PPE framework was determined to be the most appropriate for this project. The PPE framework offers a holistic understanding of how a product is experienced.

Elements of the scenario planning method outlined in Schoemaker (1995) can be applied to the process of forecasting a future communication product for the NZ Police. The short film presentations used in IDEO (2007) are an effective means of presenting forecasted scenarios to users quickly and efficiently.

The following aspects of the current portable police radio design have been established: system design, assignment of radio equipment, product architecture, product variations, battery chargers, and other accessories. A review of the current market and the state-of-the-art for portable police radios was also undertaken.

A case study from Philips (Lambourne et al., 1997) outlined potential performance and experience qualities indicative of a digital portable police radio. The study highlighted the possible inclusion of additional performance qualities, such as remote access to police files, including maps and suspect information, a memo recorder, and the ability to transfer data to and from other emergency services. This case study also highlighted the need for an investigation into potential aesthetic and affective values that are appropriate for the design of the product.

4.0 - Research Methodology

The purpose of this section is to develop a research programme methodology appropriate for the development of the product under investigation. The following subjects are examined in this section:

- Research approach
- Research methods

4.1 - Research Approach

As established in section 1.1 the aim of this investigation is to produce a Tait branded future portable communication product for the NZ Police force of 2018 that focuses on the end user by applying affective product design principles. To successfully accomplish the research aim a suitable research and design approach for the project was created. Table XX visually presents the research approach for this project.

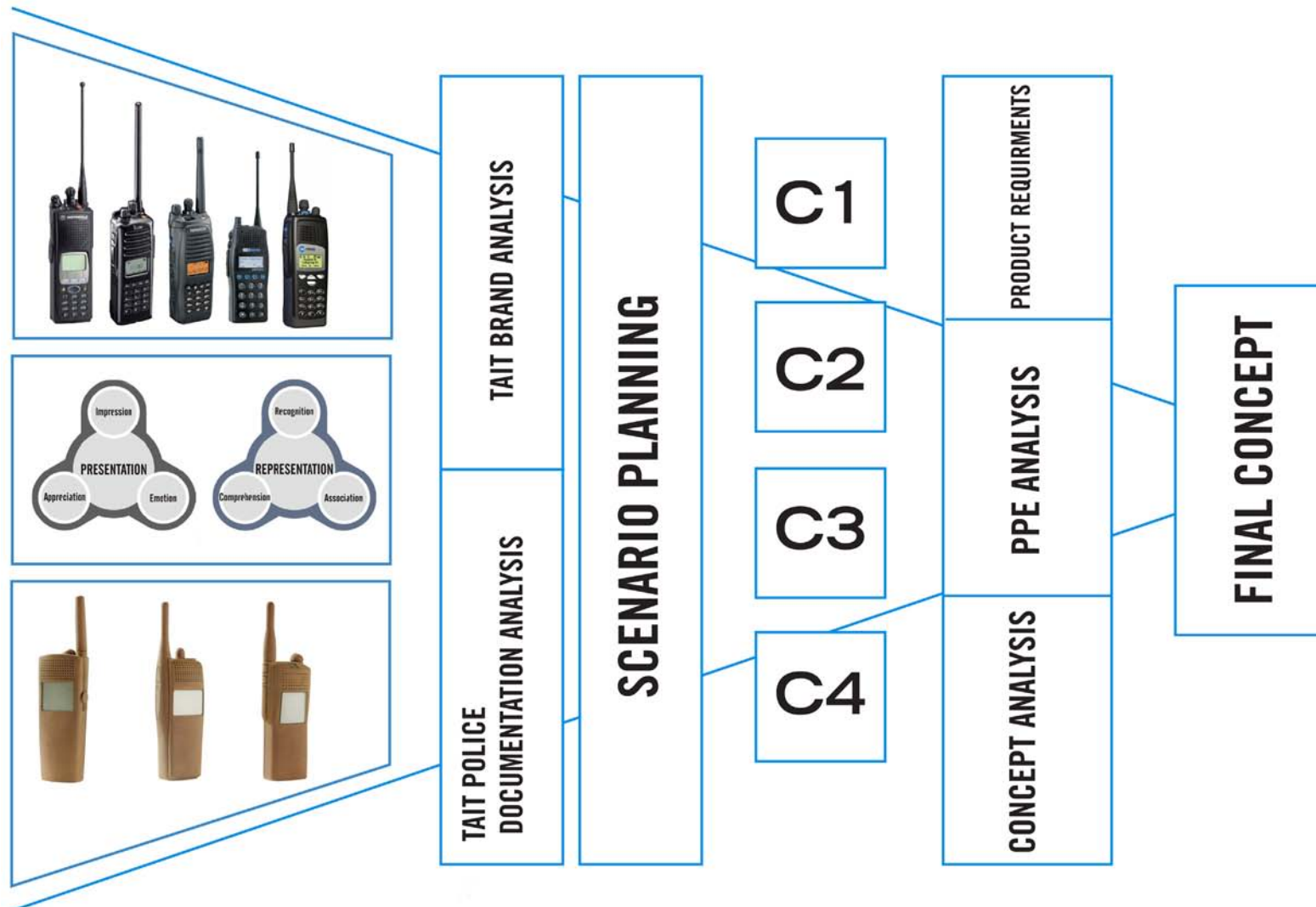


Table 4.1 - Research Approach

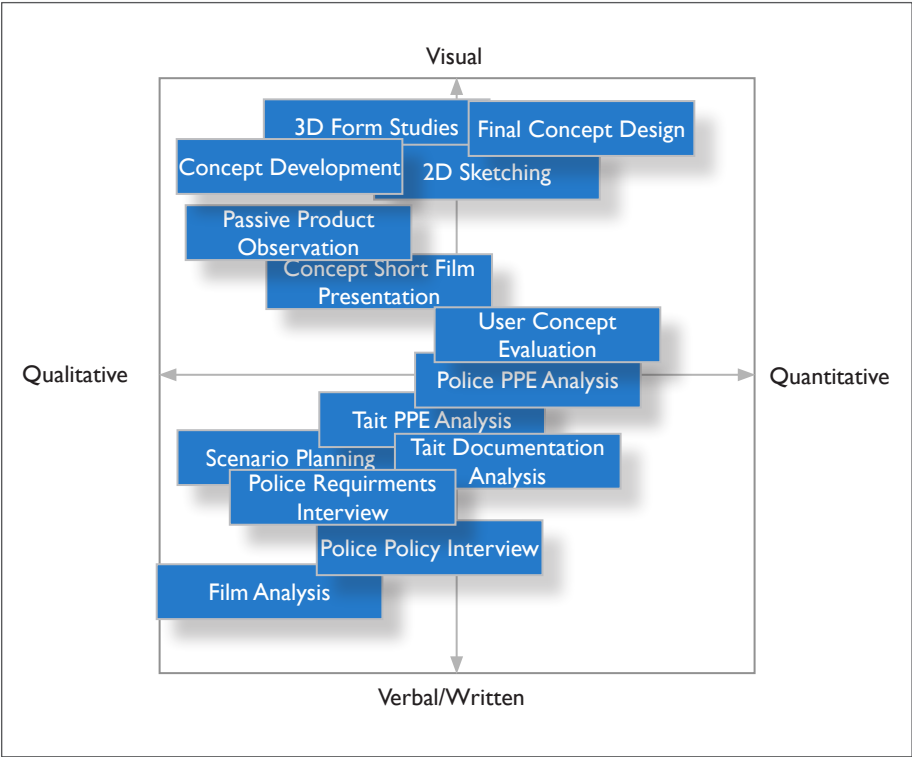


Table 4.2 - Bi-polar Process Graph

4.2 - Research Methods

The purpose of this section is to discuss the design and selection of research methods employed in this investigation. Multiple research approaches were used during this study; this included qualitative, quantitative, verbal/written and visual design methods. To simplify the presentation of these research methods they have been categorised into two modes of research (see Table 4.1):

‘Research through design’ is the application of creative design techniques as part of a design process.

‘Research for design’ places attention on design practice as a means of exploration and producing knowledge.

4.2.1 - 'Research Through Design' Methods

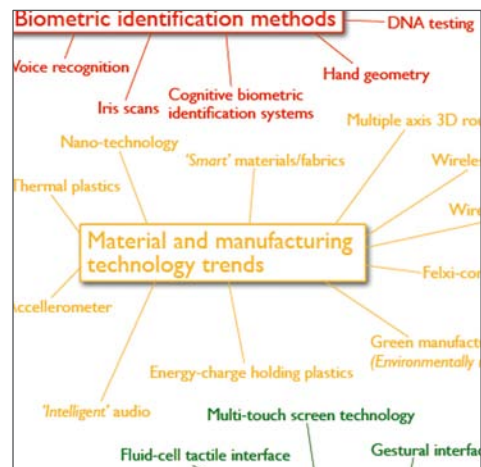


Figure 4.1: Scenario Planning

Scenario Planning (Schoemaker, 1995)

Aim:

Generate a range of hypothetical future scenarios to inform the development of four non-working portable police communication concepts.

Objective(s):

Produce four hypothetical future scenarios to inform the development of four non-working portable police communication concepts.

Procedure:

Speculative scenarios are created using a series of explorative graphs analysing contemporary and future trends in technology, communication products and the role of the NZ Police in the year 2018. Using these graphs as starting points eight future scenarios were created. These were then screened for:

- Consistency, the strength of the scenario's concept
- Plausibility, how likely the forecasted scenarios are to come into effect

As a result four future scenarios were selected. Each scenario details the following information:

- The main catalyst behind the forecasted scenario
- The 'nature' of the future communication products
- The functional aspects of the future communication product

Each scenario is named; the scenarios are like short stories. By capturing the 'essence' of the scenario in a title it makes the scenario easier to understand and remember.

Appropriateness of use:

Speculative scenario planning is an effective means of expressing a range of potential future scenarios through a holistic perspective.

Issues/disadvantages of use:

The forecasted scenarios could prove to be unrealistic or implausible.

Minimisation of disadvantages:

Scenarios are screened for consistency and plausibility according to existing knowledge and understanding of the technology and product area.

2D Sketching

Aim:	To iteratively generate 2D concepts in response to the relevant design criteria.
Objective(s):	Develop a range of 2D concepts for 3D development.
Procedure:	The researcher used a range of 2D media, including: colour pencil, permanent markers and graphite chalk to iteratively develop a diverse selection of 2D concepts.
Appropriateness of use:	2D sketching is a fast means to explore of a range of concepts.
Issues/disadvantages of use:	2D sketches have limitations when resolving 3D formal qualities.
Minimisation of disadvantages:	2D concept sketching is used in combination with aesthetic and 3D form studies.

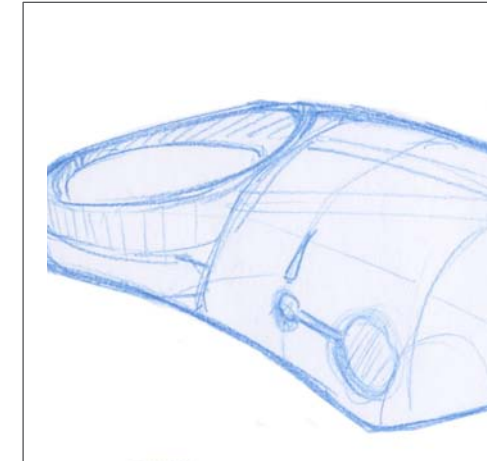


Figure 4.2: 2D Sketching

3D Form Studies

Aim:	Generate 3D concepts in response to the relevant design criteria.
Objective(s):	Demonstrate spatial and physical qualities through 3D form studies.
Procedure:	The researcher used fast modelling materials such as polystyrene, modelling clay and calico to quickly shape and sculpt concepts.
Appropriateness of use:	3D form studies are a fast effective means for developing concepts' shape/form and composition.
Issues/disadvantages of use:	Resolution of concepts is still low because of media selection.
Minimisation of disadvantages:	Used in combination with 2D concept sketching, the form studies are developed to an appropriate level.



Figure 4.3: 3D Form Studies



Figure 4.4: Concept Development

Concept Development

Aim:

Create four initial concepts in response to the design criteria from secondary research (section 3.0), forecasted scenarios (section 6.1) and Tait's police radio design criteria (section 6.2).

Objective(s):

Develop four initial conceptual police radio solutions for evaluation by the NZ Police research participants.

Procedure:

Iterative design techniques (2D form studies and 3D form studies) were used to develop four distinct concepts. Emphasis was placed on fulfilling performance and experience criteria developed through secondary research (section 3.0), forecasted scenarios (section 6.1) and Tait's police radio design criteria (section 6.2).

Appropriateness of use:

Concept development allows for a more focused iterative design and development process.

Issues/disadvantages of use:

Concept development may take an inappropriate design direction.

Minimisation of disadvantages:

The developed concepts are designed in response to the insight gained from sections 3.0, 5.1 and 5.2.

Concept Short Film Presentation

Aim:	Generate four 30-90 second short films to communicate the design features of the concepts created through the iterative design process to an appropriate standard for presentation to NZ Police officers taking part in this study.
Objective(s):	<p>Produce four 30-90 second short films that communicate the following features of the concept:</p> <ul style="list-style-type: none">- The speculative scenario on which the concept is based- Concept form and design- Body position- Concept interface (for example, screen/tactile and audio interface)
Procedure:	<p>Each film was created through the application of a film template. The film template consisted of the following:</p> <ul style="list-style-type: none">- Concept introduction- Presentation of the scenario that informed the concept's design- A 'Hero' image that introduces the concept's form and design- Communication of the concept's desired body position for use- Communication of concept's interface (for example, screen/tactile and audio interface) <p>The framing and perspective of each concept was designed to be relatively neutral and consistent to ensure the focus was on the concept's design.</p>
Appropriateness of use:	The use of short films is a fast efficient method of communicating product features in a succinct manner.
Issues/disadvantages of use:	The short films are unable to communicate tactile and physical features of the concepts, such as weight and surface texture.
Minimisation of disadvantages:	The short films are presented in conjunction with the hard-model representations of the concepts, which communicate the physical elements of the concepts effectively.



Figure 4.5: Concept Short Film Presentation



Figure 4.6: Final Concept Design

Final Concept Design

Aim:

Develop a final resolved concept that fulfils the aim of the study as defined in section 1.2 in response to the final performance and experience design criteria and insight developed through this study.

Objective(s):

Produce a refined concept model that is designed in response to the design imperatives and desirables (affective and otherwise) discovered as a result of this study.

Procedure:

The final design solution is created through iterative design process (2D and 3D media) and application of final design criteria. The final concept is then communicated through the most appropriate method(s).

Appropriateness of use:

Effective means for developing the final concept's design.

Issues/disadvantages of use:

Resolution of the final concept could lack realism

Minimisation of disadvantages:

Used in combination with 2D and 3D concept development the resulting concept will be resolved to a high level of detail to create the perception of a real product.

4.2.2 - 'Research for Design' Methods

Film Analysis

Aim:	Investigate additional sources and/or design concepts for forecasted design scenarios.
Objective(s):	Acquire additional input for scenario ideation.
Procedure:	Evaluation of future scenarios for police or law enforcement in the future as depicted in mainstream big-budget films; the films are viewed and analysed according to their plausibility, the type of communication equipment used in the films and the type of future scenario or 'story' presented.
Appropriateness of use:	Big-budget films are well-crafted highly creative visual depictions of future worlds and the conceptual products used in them.
Issues/disadvantages of use:	The scenarios depicted in the films may not be realistic due to the film's storyline and the audience's perspective of the police/law enforcement depicted.
Minimisation of disadvantages:	The researcher remained objective when evaluating the films by using set criteria for analysis and interpretation.



Figure 4.7: Robocop (1987, © Orion Pictures Corporation)

Tait PPE Framework Analysis (Warell, 2008)

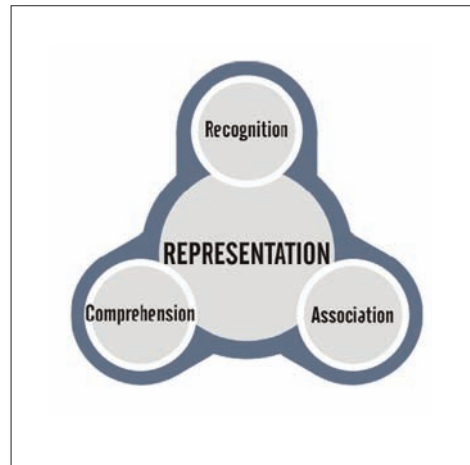


Figure 4.8: PPE - Representation Framework (Warell, 2008)

Aim:

Generate a holistic understanding (using the PPE framework (Warell, 2008)) of how and why Tait products are designed and branded from the perspective of Tait's marketing and research and development teams.

Objective(s):

Define what visual and affective product design characteristics determine a Tait branded product as a Tait product.

Procedure:

Through loosely-scripted interviews (with members of Tait's design and development team and marketing department) and analysis of relative design and marketing documentation provided by Tait a full analysis and perspective as to the brand and 'nature' of Tait's product range is determined within the parameters of the PPE framework.

Appropriateness of use:

The PPE framework is an effective means for developing a holistic perspective of the affective product design qualities relevant when designing a portable Police radio as well as what characteristics are representative of the Tait brand.

Issues/disadvantages of use:

The PPE framework does not account for aspects of the functionality and appropriateness of use for a product's design.

Minimisation of disadvantages:

Included as part of this study is an investigation and analysis of functionality and appropriateness of use of the product in question (Tait TP 9100) executed from perspective of Tait (the product's designer and manufacturer) and the NZ Police (the primary user).

Tait/Police Documentation Analysis

Aim:	The creation of police radio design criteria according to NZ Police sample user group visits conducted by Tait's research and development team.
Objective(s):	The creation of future portable radio design requirement criteria from analysis of Tait's sample user group visits with the NZ Police.
Procedure:	In July 2004 and December 2005 Tait's product development team conducted research with a sample NZ Police radio user group. The purpose of these meetings was to increase the design team's knowledge and understanding of their portable radios and accessories as part of the day-to-day work of an officer. For the purpose of this investigation the resulting documentation from these police user visits were analysed to create future police radio design criteria. Potential applications of current and future technologies were observed.
Appropriateness of use:	An effective means to explore existing knowledge and user associated design issues to create design criteria for the initial concept generation.
Issues/disadvantages of use:	Research findings are potentially outdated.
Minimisation of disadvantages:	Tait police research was conducted separately in 2004 and 2005 with similar feedback from both events.

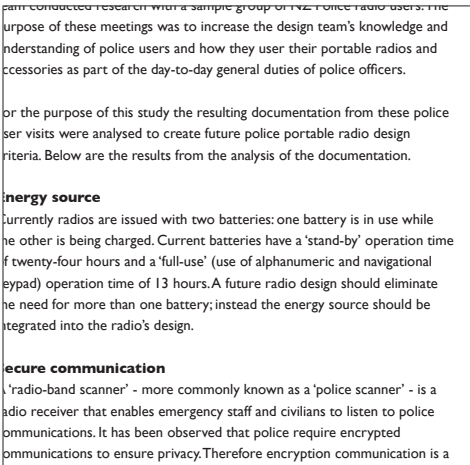


Figure 4.9: Tait/Police Documentation Analysis

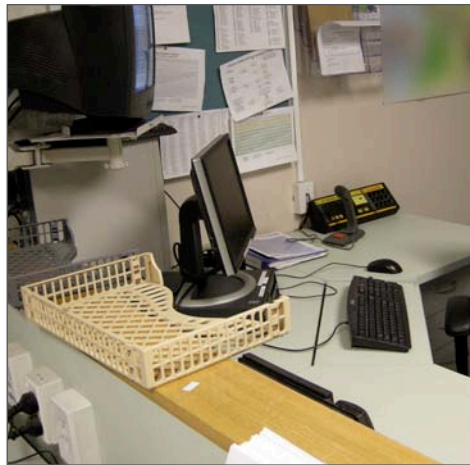


Figure 4.10: PoliceWork Station

Police Policy and Legislation Interview

Aim:	Investigate NZ Police policy and legislation associated for operation and use of portable police radios.
Objective(s):	Determine NZ Police policy and legislation for police portable radios.
Procedure:	A loosely structured interview is conducted with the police assigned liaison, discussing operation procedure and policy for police portable radios.
Appropriateness of use:	Effective means for identifying existing legislative policy requirements of portable police radios.
Issues/disadvantages of use:	Some of the requirements may not actually be in written format.
Minimisation of disadvantages:	The interview is with the NZ Police liaison, who is an experienced senior officer. The interview is conducted in a loosely structured format, to allow for discussion of such points.

NZ Police Future Radio Requirements Interview

Aim:	Investigate the usability and appropriateness of NZ Police's current portable radio.
Objective(s):	Determine the usability and appropriateness of the NZ Police current portable radios (Tait TP 9100) according to the police participants taking part in this study.
Procedure:	Officers were asked a series of questions designed to determine the current usability and appropriateness of their current portable radios.
Appropriateness of use:	This method allows for identification of specific user orientated suitability issues with current police radios.
Issues/disadvantages of use:	Issues of usability and appropriateness are best determined 'in the field'.
Minimisation of disadvantages:	The 'ride-along' method is used as part of this investigation.



Figure 4.11: Police Patrol Car

Police PPE Analysis (Warell, 2008)

Aim:	Determine what aspects of the PPE framework are of most importance for current police portable radio users.
Objective(s):	Utilise the PPE framework to generate a holistic understanding of how the target users (NZ Police) perceive their current portable radios (Tait TP 9100).
Procedure:	Through loosely scripted interviews (with NZ Police portable radio users) and a set of questions about the following aspects of police portable radio design. Because the presentation mode (see section 3.1) is harder to determine for non-designers, officers are not asked about their perception of the product in that mode. Officers are however asked to determine their perceptions of their radio in the representational mode (see section 3.1), for example, recognition, comprehension and association. This is all done to determine the 'nature' of Tait's portable police radio according to a sample group of NZ Police officers.
Appropriateness of use:	An effective means to determine how the target user perceives their radio in the representational mode of PPE.
Issues/disadvantages of use:	Findings could be distorted due to 'chatter' between officers in-between interviews.
Minimisation of disadvantages:	The user sample group is sourced from different police sections, e.g.: officers who will not be able to talk due to differences in shift times.

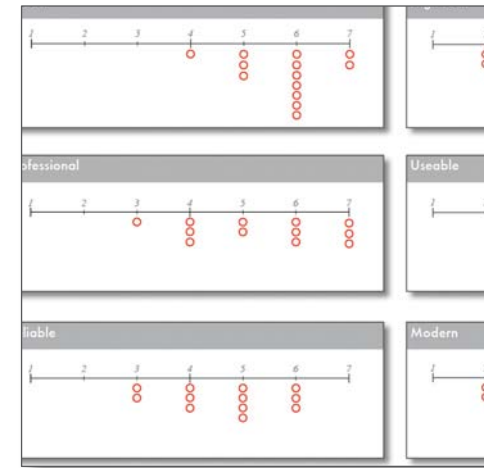


Figure 4.12: PPE - Comprehension Analysis



Figure 4.13: Concept Presentation

User Concept Analysis

Aim:

Gauge NZ Police officers' perceptions of design and appropriateness of the four concepts generated earlier in the investigation.

Objective(s):

Determine what aspects (results are separated into performance and experience) of the four concepts are suitable for further development according to the product's target users (NZ Police officers).

Procedure:

NZ Police officers are presented the four non-working conceptual communication products previously created through this study. Officers were asked to determine the positive and negative aspects of each concept. Officers were then asked to state their personal and professional preference for aspects of the concepts. Direct focus was applied to the usability and appropriateness of the concepts. This information was divided into performance and experience criteria.

Appropriateness of use:

A constructive approach to deciphering the appropriateness of the presented concepts.

Issues/disadvantages of use:

Officers may interpret concepts as resolved products.

Minimisation of disadvantages:

The concepts are presented in development format, to give the impression they are still in the development stage of the design process.

Passive Product Observation (*Ride-Along*)

Aim:	Investigate additional sources of inspiration and/or design issues for the forecasted radio concept in context.
Objective(s):	Conduct user/product observations leading to potential additions to design criteria for a future police radio.
Procedure:	This method required the researcher to be an objective observer during multiple shifts with separate groups of NZ Police officers. The researcher observed how and why officers used their current forms of communication (radios and other) and looked for potential additions to the design criteria for the future radio product.
Appropriateness of use:	The passive product observation research method is a constructive and creative means of gaining new insight into possible rituals and/or design possibilities that might be otherwise missed through other research methods.
Issues/disadvantages of use:	Findings can be highly subjective.
Minimisation of disadvantages:	The researcher remained as objective as possible while undertaking this research method.



Figure 4.14: At the Station

4.3 - NZ Police Conditions For Research

To conduct research with the NZ Police the researcher was required to provide a proposal to the NZ Police Research & Evaluation Steering Committee (RESC). This research proposal detailed the following:

- The purpose of the research
- The research objectives
- Time requirements from the NZ Police
- Resource and personnel requirements from the NZ Police
- Ethical considerations for the project
- Security of information provided
- Standard of research being conducted

Once the research proposal was accepted a research agreement between Frazer Ellis ('the Principal Researcher') and Her Majesty the Queen in Right of her Grant in New Zealand acting by and through the Commissioner of Police was drafted (see Appendix 01). In the document the researcher's and the NZ Police's obligations to each other and to the project were officiated. The primary considerations included:

- All information provided by the NZ Police is treated as confidential until established otherwise
- All information provided is viewed at police premises

- The researcher must ensure that confidential information obtained from the NZ Police is protected by such security safeguards as it is reasonable to take in the circumstances against loss, unauthorised access, use, modification, disclosure or misuse
- The NZ Police liaison should provide the researcher with such access to police staff, premises, resources, information and assistance as is reasonably necessary to carry out the project
- Conditions of research agreement termination (see Appendix 01)
- No amendments to the research agreement can be effective unless agreed upon and signed by both the researcher and NZ Police

4.3.1 - Information Confidentiality

Confidentiality of information for this investigation was treated in the following ways:

A) Written documentation confidentiality

Research participants are only identified by gender and their position held in the NZ Police, to assure the investigation has a good representative sample of users. Any further information has not been recorded because it is not relevant to the study, along with declarations of the research participant's anonymity.

B) Photographic confidentiality

Before any photographic documentation was taken the researcher requested permission from the participants and NZ Police liaison assigned during the event. Any photo documentation that contains imagery of third party respondents (e.g.: members of the public, or otherwise) was altered so they cannot be identified.

4.3.2 - Effects of Research

Following a peer review of the research methods and approach for this investigation it was established that there would be no physical or psychological harm to the participants resulting from this study.

4.3.3 - Participant Selection

The NZ Police liaison was provided with criteria for research participants. The desirable participant profile was:

- Sworn NZ Police officer
- Regular portable radio user

The criteria also requested the sample of officers that took part in the study was diverse in experience and age. With these criteria in mind the liaison provided the researcher with officers willing to participate.

4.3.4 - Informed Consent

All research participants were provided with an information sheet that detailed the following:

- The research and project aims
- The participants' right to withdraw or discontinue from the research project
- Their involvement in the research
- How their input will be used
- Time requirements
- Their anonymity

4.3.5 - Safety Concerns

Only during the 'passive product observation' (police ride-along) could the researcher be in a situation that could be un-safe. During this aspect of the research the researcher was instructed to follow police instruction; furthermore, the researcher has mandate to 'stay out of trouble'. If required the researcher would stop the research and seek alternative means of transport home, e.g.: take a taxi. It was advised that the NZ Police would use their discretion to minimise the amount of safety risks to the researcher to an acceptable level of safety.

4.3.6 - Ethical Considerations

This investigation was deemed to only require a Low Risk Notification by the Massey University Ethics Committee, following a Peer Review process by the researcher and the project supervisors. As part of this peer review process the Massey University Code of Ethical Conduct was consulted. Further details are available from:

Massey University Human Ethics Website:

<http://humanethics.massey.ac.nz/massey/research/ethics/human-ethics/code/code.cfm>

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5.0 - Forecasting / Tait Research

The purpose of this section is threefold:

- 1) Generate a range of hypothetical future scenarios to inform the concept development stage of the project. This is done through speculative scenario planning (Schoemaker, 1995), with additional insight gained from analysis of films
- 2) Determine the visual and experiential design cues that are characteristic of a Tait product and how the Tait brand can be applied to a future police portable communication product. This is done through the application and analysis of the PPE framework (Warell, 2008) to a selection of Tait's products.
- 3) Create initial design criteria for a future police portable radio through the analysis of Tait documentation from police radio user visits. These design criteria will be used to inform the creation of four initial concepts

5.1 - Forecasting

The purpose of this section is to develop a series of hypothetical future scenarios from which four future radio concepts can be constructed. The primary research method used to do this is speculative scenario planning (Schoemaker, 1995). Additional insight is gained from the analysis of big-budget films that present potential future police communication products and scenarios.

5.1.1 - Film Analysis

Films are analysed as part of this study because they are well-crafted highly creative means of presenting a future world and the products that are used in them. The films selected for this study all depict police or the equivalent thereof, in a future tense. The following films were the focus of this analysis:

- Robocop (1987)
- Judge Dredd (1994)
- I, Robot (2004)
- Demolition Man (1993)
- Minority Report (2002)
- The Fifth Element (1997)

To identify what trends in product design and functionality are consistently presented in the films and why, the following information about each film was determined: the type of future presented i.e. dystopian, utopian; what the basic storyline is and whether the communication product(s) play a major part in the film; how the law enforcement characters are depicted, for example hapless or intelligent; the type of communication equipment used and the basic design concept(s) behind them.

Once this information was established the communication products were checked for plausibility in relation to the product's concept and the technology used. Through analysis of the films four consistent product features were determined: biometric identification, wireless audio communication, comms uplink and remote access to police database.

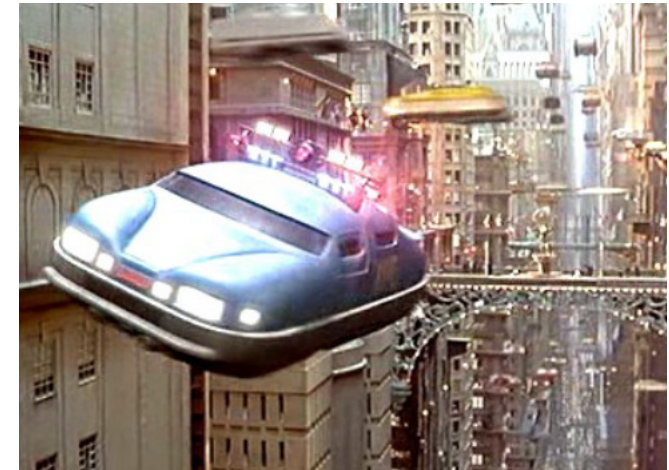


Figure 5.1: Fifth Element (1997, © Gaumont)



Figure 5.2: Judge Dredd (1994, © Hollywood Pictures)



Figure 5.3: Robocop (1987, © Orion Pictures Corporation)

Biometric identification

Fast effective methods of biometric identification, including vocal recognition, facial recognition and types of iris scanning, were used in all of the movies analysed. The process of identifying an individual would take less than five seconds to execute. Depending on the film's plot, individuals were either identified according to a criminal record or a general citizen record. In the movie *Minority Report* (see figure 5.5) the mainstream form of identification is an iris scan. This concept is pushed to the extreme that an individual can be located and have their movements tracked. The film depicts a CCTV (closed circuit television) system that is paired with a type of iris scanning and identification system to do this.



Figure 5.4: I, Robot (2004, © 20th Century Fox Film Corporation)

Wireless audio communication

All the movies that were analysed depicted wireless communication options for the law enforcement characters. It was observed that as a plot device, the central character(s) would at some stage during the film engage in a conversation with an individual via a wireless communication system. A large number of the audio communication systems were integrated into headgear, which in some situations visually did not look appropriate.

Comms uplink

Although dependent on the film's plot, police communication systems were depicted as being able to communicate through a live digital communication system, with integrated voice recognition and command functions. Officers were able to select a group or individual to talk to as well as retrieve file information from a comms operator or a database.



Figure 5.5: *Minority Report*. (2002, © 20th Century Fox Film Corporation)

Remote access to police database

Access to police files, including relevant suspect information (gained through a form of biometric identification), street address information, including direction to and information about the residents and any address information that could be relevant to an officer i.e. an up-to-date floor plan.



Figure 5.6: *Demolition Man* (1993, © Warner Bros. Pictures)

5.1.2 - Scenario Planning

The aim of this section is to generate a range of hypothetical future scenarios to inform the initial design and development process (see section 6.0). Based on Schoemaker's scenario planning method (1995) three explorative graphs were created. These graphs explored trends in the following areas: current and future technology, communication products and NZ Police future trends (see tables 5.1, 5.2 and 5.3).

Using these graphs and the insight gained from the analysis of the films eight future scenarios were generated, see over the page.

Each scenario details a short narrative about the future world, the basic 'nature' of the communication product and the main catalysts for each future scenario and the effects and requirements these changes have had on the communication equipment that is used by the police.

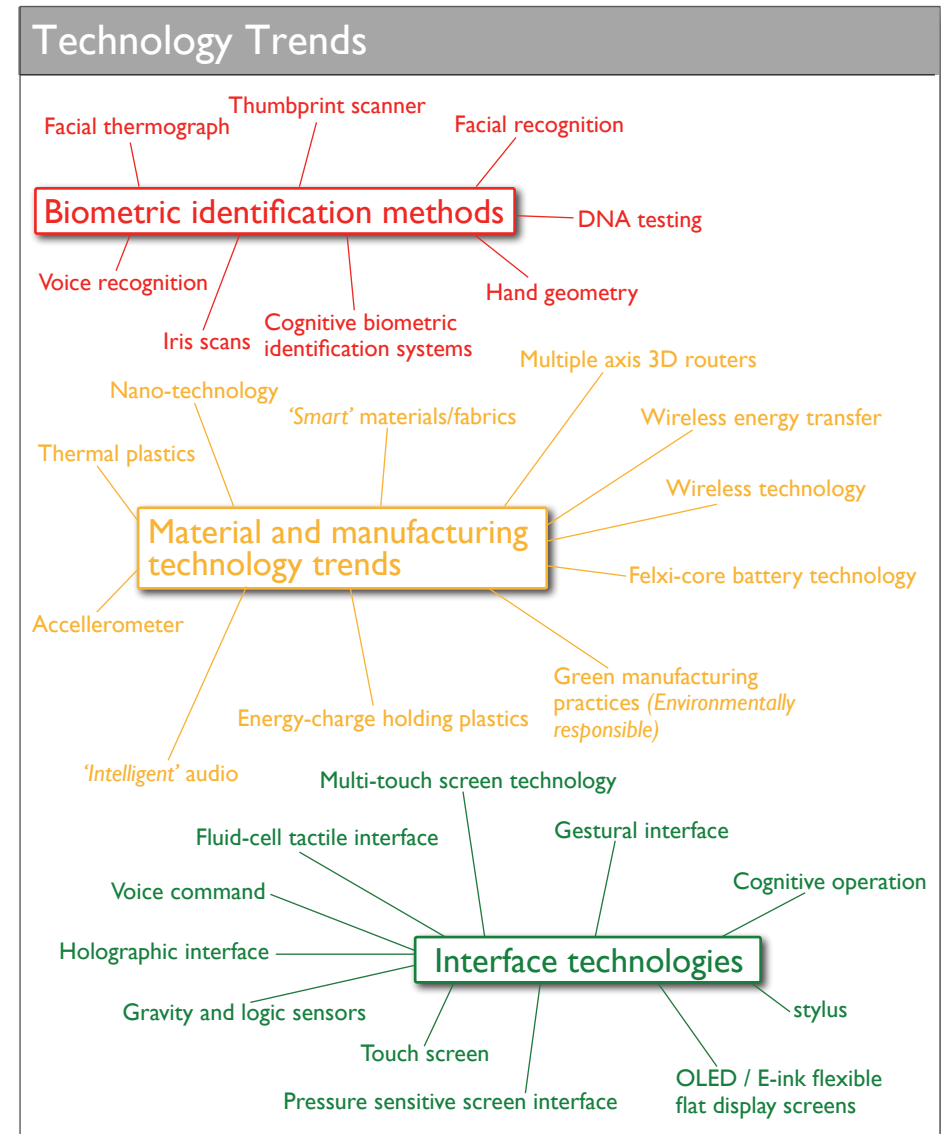


Table 5.1: Technology Trends

Communication Products Trends

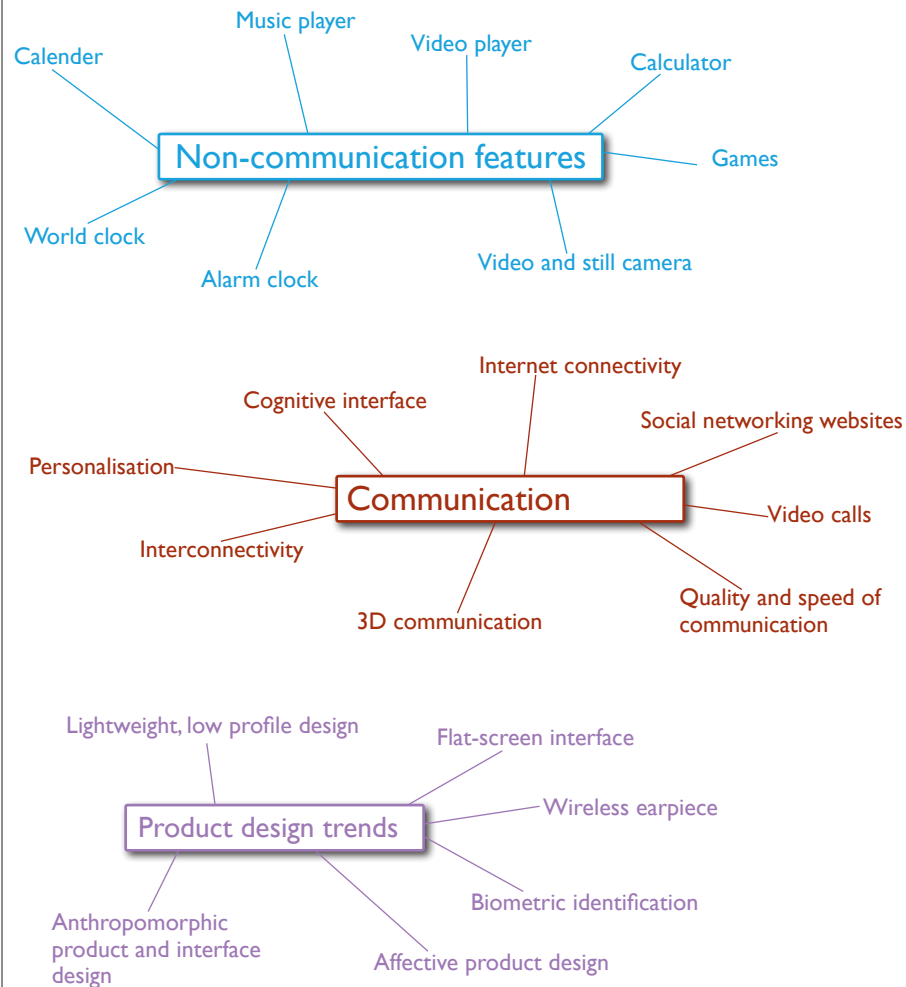


Table 5.2: Communication Product Trends

NZ Police Future Trends

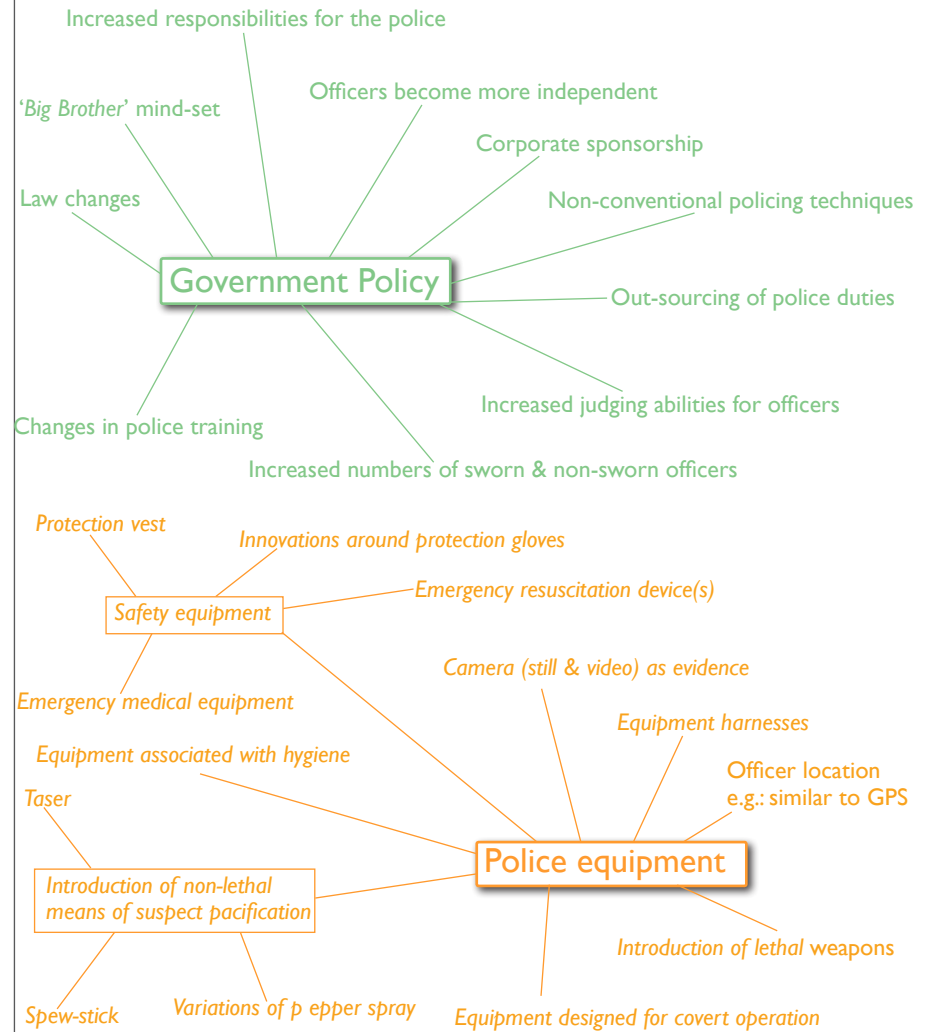


Table 5.3: NZ Police Future Trends

Economic Crises

Due to an international economic depression the number of police has increased exponentially. As a result of this, existing police communication systems have become crowded with chatter. Audio communications are no longer person-to-person, but rely on sending and receiving digitally encrypted files that are reconstituted into simulated verbal communication. Communication equipment is designed to disguise the mouth's movements and prevent eavesdropping.

Safety

After an escalation in armed violent crime the NZ Police have been forced to militarise their on-the-beat personnel. To deter crime all the equipment used by the NZ Police is aesthetically aggressive and designed to evoke strength and unity among officers. Police have been equipped with firearms and are required to be in constant contact with police comms for the duration of their shift. To effectively and safely operate their firearms the police employ a hands-free communication product.

Big Brother

A substantial increase in petty crime has prompted the New Zealand government to install a vast network of CCTV (closed-circuit televisions) and other surveillance systems in public areas. This 'big brother' scheme has altered how the police operate. To increase the transparency of the NZ justice system, officers are required to carry a device that independently records their encounters with the public. A modest tactile interface is utilized to reduce time spent operating their communication device.

Hackers

Due to an increase in network hacking and misinformation the NZ Police have made drastic changes in their communication system's design. This has necessitated a huge increase in the security of information delivery. All officers are required to undergo cognitive implants to ensure authentic identification. Biometric identification technology is integrated into officers' personal communication devices.

Malthusian

Due to a global overpopulation problem, a bold rightwing Government has granted the NZ Police the power to pass judgment instantly on the majority of petty crimes. Officers are required to carry a device that has a real-time uplink to a computer that effectively judges cases.

Sustainability

As part of an international movement to make all conventional practices more sustainable the NZ Police have been instructed by the government to only purchase environmentally responsible equipment. This focus on sustainability extends to social responsibilities (to be proactive in dealing with issues of environmental concern) as well. As the police are required to enforce strict environmental regulations, communication devices are equipped with a tool that calculates energy overuse and resource expenditure.

Terrorism

International terrorist attacks have created a requirement for instantaneous inter-agency communication. A governmental policy requires a common communication device across the NZ emergency services. This results in a generic product design that has a multi-format communication ability. The communication equipment is designed for the “lowest common denominator” user.

Gunslinger

Due to a change in government policy the responsibilities of the NZ Police have been contracted out to private enterprise. This newly created policing force is equipped with consumer products much the same as professional sports teams, for example brand sponsorship. The communication equipment is designed to evoke an image of professionalism and power. Classic motifs of masculinity are employed to make the product desirable to officers and civilians alike.

Because it was impractical to develop eight separate concepts the eight scenarios were screened for consistency, the strength of the scenario, the logic behind the scenario's concept, and plausibility - how likely it is that the scenario will come to fruition (see Table 5.4).

As a result of this analysis the following scenarios were selected for concept development:

- Big Brother
- Safety
- Sustainability
- Gunslinger

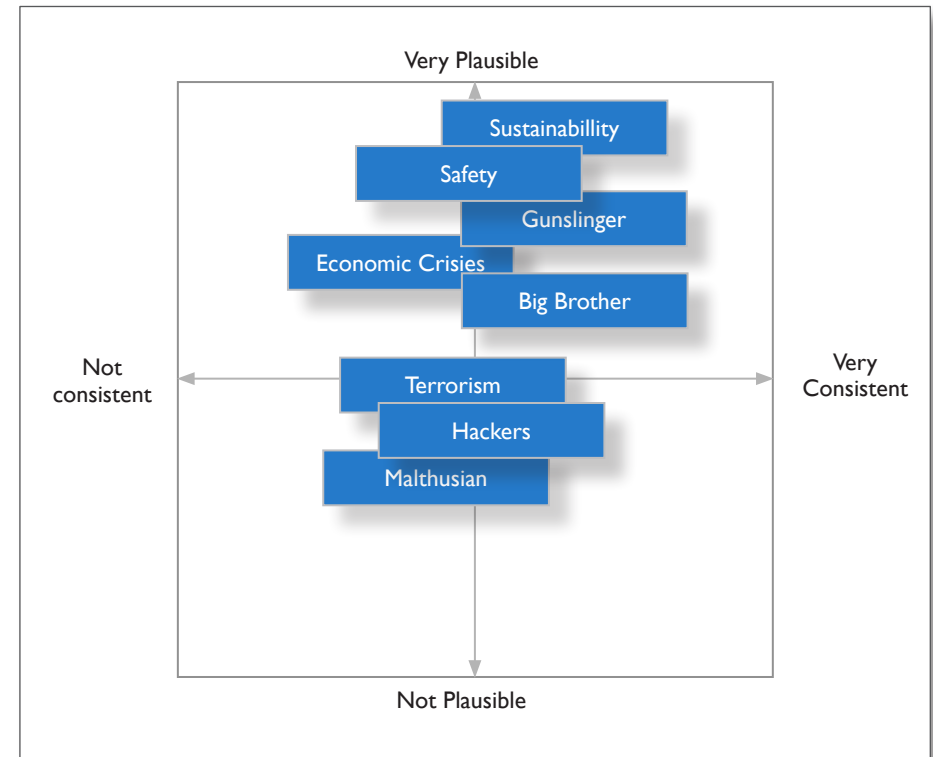


Table 5.4: Plausibility / Consistency Bi-polar Graph

5.2 - Tait Research

This section as has two aims:

- To ascertain the visual and experiential design cues that are characteristic of a Tait product and how the Tait brand can be applied to a future police portable communication product.
- Create initial design criteria for a future police portable radio through the analysis of Tait documentation from police radio user visits.

5.2.1 - Tait Product Analysis

The purpose of this section is to determine what the visual and experiential design cues are that form the product experience for the Tait brand. To do this the PPE framework (Warell, 2008) has been applied to a range of Tait products.

Due to the development and engineering process required to develop a new product and the modest size of Tait Electronics (the company), new products are released every twelve to twenty four months. As a result of this brand and product development is required to be relatively conservative, so to maintain a strong consistent aesthetic among products.

For the purpose of this study the products that have been analyzed are all relatively modern in design and technology. The following products have been reviewed using the PPE (Warell, 2008) framework:

- TB8100 Base Station - Repeater
- TM8000 Mobile Radio
- TP8100 Portable Radio range
- TB9100 Base Station - Repeater
- TM9100 Mobile Radio
- TP9100 Portable Radio range
- TM9155 Hand-Held Control Head


TB8100 Base Station - Repeater	Presentation	Representation
	Impression Low design quality, complicated internals	Recognition Large, bulky, reliable, packhorse
	Appreciation Minimal visual appeal	Comprehension Minimal control functions, large cooling fan's
	Emotion Bored, disappointed	Association Large, boxy, non-consumer product

Table 5.5:TB100 Base Station - Repeater PPE


TM8200 Mobile Radio	Presentation	Representation
	Impression Slightly toy like in aesthetic value	Recognition Archetypal Mobile radio composition, reliability
	Appreciation Visually easy to understand and use, Large buttons	Comprehension Inviting - Speaker/microphone, large easy to use buttons, simplistic screen
	Emotion Neglect the product does not feel professional	Association Looks like a toy, looks sturdy, to colourful

Table 5.6:TM8200 Mobile Radio PPE


TP8100 Portable Radio Range		
	Presentation	Representation
	Impression Rounded product features, conservative but organic form	Recognition Robust, compact, professional looking tool
	Appreciation Smooth and inviting to hold, slightly stumpy product appeal	Comprehension Areal and control knobs
	Emotion “I feel professional”	Association European product styling, small refined but well made

Table 5.7:TP8100 Portable Radio Range PPE


TM9155 Hand-Held Control Head		
	Presentation	Representation
	Impression Initting curves	Recognition refined but still sturdy product proportions
	Appreciation Smooth to touch	Comprehension Inviting to hold product form
	Emotion Satisfaction due to the shape of the speaker/microphone	Association Reliability, Importance, strength

Table 5.8:TM9155 Hand-Held Control Head PPE


TB9100 Base Station - Repeater		Presentation	Representation
		Impression Lack of design intent, un-desirable aesthetic	Recognition Large, bulky, complicated internal components
		Appreciation Minimal visual appeal, limited interface	Comprehension Minimal interface and control functions, large cooling fan's
		Emotion Bored, disappointed	Association Large, boxy, non-consumer product, devoted to one set of tasks and no other

Table 5.9:TB9100 Base Station - Repeater PPE


TM9100 Mobile Radio		Presentation	Representation
		Impression Underlying feel of the product is a toy, to many visual bulges	Recognition Archetypal Mobile radio composition, professionalism
		Appreciation The platinum screen surround increase sense of professionalism	Comprehension Inviting - Speaker/microphone, large easy to use buttons
		Emotion Serious, little to no emotional response	Association Reliability, Importance, strength

Table 5.10:TM9100 Mobile Radio PPE


TP9100 Portable Radio Range	Presentation	Representation
	Impression Authoritative product, through boxy form. Visually strong	Recognition Robust, reliable, professional looking tool
	Appreciation The visual strength and composition of the radios	Comprehension Areal and control knobs, boxy product form
	Emotion Confidence and dependability	Association Large conservative 'American' product styling

Table 5.11:TP9100 Portable Radio Range PPE

5.2.2 - Tait Format Analysis Matrix









		Matte Black Colour	Platinum Screen Surround	Orange Emergency Button	Green Backlit Display	Rectangular Forms	Rounded Triangular Details	Rounded Form Details	Tait Logo	Textured Surface	2-Shot Moulding
											
											
											
											
											
											
											

Table 5.12: Tait Format Analysis Matrix

5.2.3 - Tait Product Visual Identity Analysis



Figure 5.7: Tait TM9100 Mobile Radio and TP9100 Portable Radio

Colour application

Colour application throughout Tait products is conservative; the primary colour used is matte black. Orange is used to colour the emergency key on all products (that are capable of an emergency function). A green backlit display screen is consistent throughout Tait products.

All the digital products contain a platinum coloured display screen surrounding; this is done to visually differentiate the digital product range from the analogue product range. The platinum colour also visually communicates the increased value and technology contained in the digital product range. It was observed that the application of colour between the various products is slightly inconsistent; this is due to the associated difficulties of applying colour to different materials.



Figure 5.8: TB8100 Base Station - Repeater and TP8100 Portable Radio

Materiality / surface texture

A central theme that is consistent through all Tait products is the application of a lightly textured plastic surface. This material is selected because of its robustness and resistance to being damaged when dropped or treated roughly. Display screens are capped with a type of scratch resistant material, again to reinforce the durability and robustness of the products. Product joins and part-lines are designed to be minimal in profile to increase the product's perception of quality and professionalism.

2-shot moulding is used throughout the portable product ranges (TP9100 and TP8100). The aim of this is to increase the robustness and durability of the products, while also differentiating Tait products from their competitors.



Figure 5.9: TM9155 Hand-Held Control Head and TP9100 Portable Radio TM8200 Mobile Radio

Form / proportion

The main driver for the design and proportion of control functions are positioned to give maximum usability. Basic rectilinear shapes are used consistently throughout Tait's product range; this is done to reinforce the perception of usability and consistency among Tait products.

Portable radios and hand-held speaker/microphones attached to the base stations are smooth in shape and are pleasant to hold for a wide range of hand sizes; this increases the perception of usability and professionalism.

5.2.4 - Tait Brand Analysis

Tait's visual product formats are largely dictated by the technological requirements of the product. For example, the TP9100 digital portable radio is larger in size than the TP8100 analogue portable radio. This is because the technological requirements for the TP9100 demand a larger amount of space.

There is no gain in using form and product features that could be obsolete in the design of a future portable radio. For example: control knobs might not be used in the year 2018. So for the purpose of this investigation Tait's brand values have been determined. These values can be universally applied to a future product in conjunction with the visual design cues ascertained in the previous section (colour application, materiality, surface texture and form / proportion).

Through loosely structured interviews with members of Tait's marketing and design departments and analysis of Tait industrial design specification documentations, a summary of Tait's brand values for a portable radio was determined:

- Robustness
- Reliability
- Professionalism
- Usability

Robustness

A central product requirement and marketing device used for Tait portable products is their robustness. The choice of materials and surface textures all aim to create a strong and damage resistant product; the by-product of this requirement is the perception of robustness.

Professionalism

A limited colour palate provides a clean, sharp and professional visual narrative. Tait products are finished with a basic set of complementary colours: matte black for the main body, orange to signify an emergency function and platinum. Platinum is currently used as an aesthetic detail to differentiate the digital product range from its competitors and other products in the Tait brand.

To communicate a higher level of product quality and in turn professionalism, the manufacturing quality of Tait products is maintained to a high standard.

Reliability

Like robustness, reliability is incidental due to the product's engineering. Currently portable radios are required to meet international standards of reliability and robustness (especially portable police radios). To increase the perception of reliability the Tait portable radios are designed to be simple and easy to use. If the control functions of the radio are simple then a resulting perception is that the radio's workings are simple and therefore less likely to fail.

Usability

The form and composition are designed to evoke ideas of mission critical product design, meaning the product is designed for optimal functionality and usability, because the operation of the product is crucial to the successful completion and undertaking of the task at hand. Access to control functions (the current examples being alphanumeric keypads, PTTs and control knobs) should be designed to be easy and uncomplicated; this is done through uncluttered product design and control function composition.

5.2.5 - Tait Police Documentation Analysis

In July 2004 and December 2005 Tait's product design and development team conducted research with a sample group of NZ Police radio users. The purpose of these meetings was to increase the design team's knowledge and understanding of police users and how they use their portable radios and accessories as part of the day-to-day general duties of police officers.

For the purpose of this study the resulting documentation from these police user visits was analysed to create future police portable radio design criteria. Below are the results from the analysis of the documentation.

Energy source

Currently radios are issued with two batteries: one battery is in use while the other is being charged. Current batteries have a 'stand-by' operation time of twenty-four hours and a 'full-use' (use of alphanumeric and navigational keypad) operation time of 13 hours. A future radio design should eliminate the need for more than one battery; instead the energy source should be integrated into the radio's design.

Secure communication

A 'radio-band scanner' - more commonly known as a 'police scanner' - is a radio receiver that enables emergency staff and civilians to listen to police communications. It has been observed that police require encrypted communications to ensure privacy. Therefore encryption communication is a requirement when designing a future police radio.

System design

Utilising the current 'channel-based' radio system the NZ Police radio systems are streamlined into three basic channel designations:

- Channel 1: Main communication channel (comms contact and assistance)
- Channel 2: Enquires (licence and identification checks)
- Channel 3: 'Chit-chat' (general use, non-devoted function channel)

This is the system design for the Christchurch Police (the region that took part in the Tait police radio user visits), at the time of Tait's user visits.

Most officers carry their own personal cell phone while working. These cell phones are used when officers need to talk directly and privately to an individual who is not on the police radio network. Officers are not issued cell phones as part of their standard equipment because they are inappropriate for police use and are expensive to run. The future radio should have the ability to communicate with multiple individuals (point-to-multi-point) as well as the ability to conduct a private conversation (point-to-point) (see section 2.4).

Mobility

Police radios are used in urban and city areas alike. There is a need for a radio that can be operated when pursuing an individual, potentially through bushes and over fences. The ability to comfortably enter and exit from a vehicle with the radio attached to the user is very important. The radio also needs to be ambidextrous.

Operational environment

The role of the NZ Police officer requires a radio that performs consistently in all weather conditions. Not only does the radio need to maintain a high standard of reliability in adverse conditions, it must also retain ease-of-use in bad weather. NZ Police officers are issued with thick leather gloves (for handling potentially dangerous objects). These gloves can interfere with the operation of the radio, due to the diminished tactile sensation when operating the controls (currently the control knobs and alphanumeric and navigational keypads). The future radio must be adaptable to changes in the environment, which include future trends in police apparel and other equipment.

Emergency function

Audible and visual feedback is not desirable when operating an emergency function. Although police users require a level of furtiveness during conversation with comms, there is potential for some kind of tactile or aesthetic feedback when operating an emergency function. A suggested addition could be tactile response similar to a pulse/heart beat. It was also noted that operation of the emergency function must be deliberate and not accidental.

Radio accessories

Current radio accessories - speaker/microphones, belt-clips/holders and holsters and earpieces (see section 3.3.6) - are used to extend the functions and customise the operations of the radio according to the individual requirements of the user. For example, the speaker/microphone accessory is used to extend the audio and speaker functions of the radio to a more appropriate position on the radio user's body. The future radio should not require the use of accessories; the radio should instead be designed with the current accessories in mind, especially their functions and how those functions could be incorporated into the future radio design

Hands-free equipment has a strong potential for future use, because certain officers (such as dog handlers) have an increased requirement to do things with their hands other than operate their radio. Due to hygiene issues around earpieces the future radio should offer a range of audio options when designing an earpiece.

5.2.6 - Tait Police Documentation Criteria

Performance Criteria	Required	Desirable (High)	Desirable (Moderate)	Desirable (Low)
The future radio must accommodate officers of all shapes and sizes	<input type="radio"/>			
Able to operate in both radio assignment scenarios (see section 3.3.2)	<input type="radio"/>			
Have an emergency function that is appropriate for covert use		<input type="radio"/>		
Able to preform in adverse weather conditions	<input type="radio"/>			
Hands-free operation		<input type="radio"/>		
Encrypted communications (audio and other)	<input type="radio"/>			
Ambidextrous operation	<input type="radio"/>			
Integrated energy source			<input type="radio"/>	

Table 5.13: Tait/Police Performance Design Criteria

Experience Criteria	Required	Desirable (High)	Desirable (Moderate)	Desirable (Low)
Easy-to-use interface		<input type="radio"/>		
Appropriate for covert situations as well as normal operation			<input type="radio"/>	
Complementary to the officer's equipment (consistent functionality irrespective of other police-issued equipment)	<input type="radio"/>			
Comfortable and unobtrusive to the user, especially when entering and exiting a vehicle		<input type="radio"/>		
Appropriate for use through rough and challenging terrain		<input type="radio"/>		
'Fail-safe' operation (will not fail in operation)	<input type="radio"/>			

Table 5.14: Tait/Police Performance Design Criteria

6.0 - Concept Ideation and Development

The purpose of this section is to create four hypothetical communication product concepts through an iterative design process (2D sketching and 3D form studies). The product concepts are created from insight and design criteria from the following sections:

- Insight gained through background research (section 3.0)
- Forecasted scenarios (section 5.1)
- Future police requirement design criteria (section 5.2)

Each concept is designed to explore a different possible direction from which the final product concept design could be based on. The functionality of the concepts is derived from the insight and design criteria determined through analysis of Tait documentation of Police radio user visits (see section 5.2.5). Each concept is based on a forecasted future scenario (see section 5.1.2). These scenarios define the product requirements, basic product 'nature', the reason behind the change in product design and a description of the product's design requirements.

For this stage of the investigation it was determined inappropriate to design each product to incorporate the Tait branding and aesthetic styling.

The purpose of this section is to explore new possibilities in the design of police radios. Each concept is assigned a set of product associations from which to be designed around. Much like the forecasted scenarios created in section 5.1 the product association's sets are designed to explore potential avenues for the final product to represent.

The concepts are presented to a similar standard of resolution materiality, design resolution, manufacturing techniques and coloration. This is done so that research participants (NZ Police) can focus on the products design.

Once designed a short film was created for each concept that showed the products functionality, basic aesthetic appeal and the scenario from which it was based. (see Appendix 01).

6.1 - Gunslinger

Gunslinger

Due to a change in government policy the responsibilities of the NZ Police have been contracted out to private enterprise. This newly created policing force is equipped with consumer products much the same as professional sports teams, for example brand sponsorship. The communication equipment is designed to evoke an image of professionalism and power. Classic motifs of masculinity are employed to make the product desirable to officers and civilians alike.

Product Stream A - "Gunslinger"

- Performance driven
- Consumer desirability
- Advanced technology
- Aesthetic flair
- Sleekness

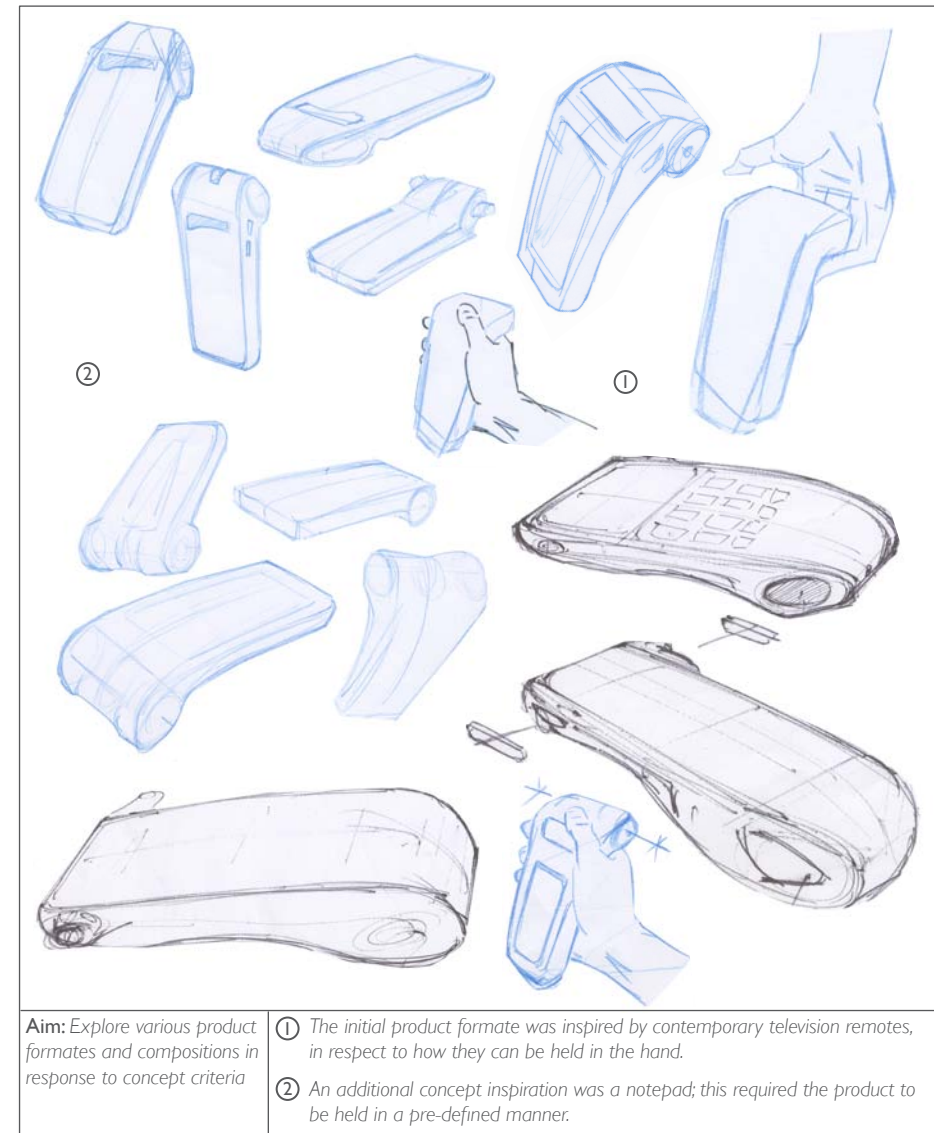


Figure 6.1: Gunslinger Early Ideation



Figure 6.2: Gunslinger 2D Sketching



Figure 6.3 Gunslinger 3D Form Studies

6.1 - Gunslinger

Concept one consists of three components:

- The main radio unit that has a touch screen interface
- The wireless earpiece
- The belt holder

Officers are required to identify themselves to use their radio via a thumb print recognition system. Once logged on the officer is given access to the national Police database and communication systems. Utilizing the touch-screen interface officers are able to retrieve information from the national Police database; this includes the access location and street address information along with other desirable information that an officer could potentially require.

To increase provide a high level of privacy of communications a Wireless earpiece is used. The wireless earpiece acts as a speaker/microphone and is electronically tied to the radio unit; this removes the need for an internal power source. To operate the channel and volume functions of the radio the touch-screen interface is used.

The radio can be positioned at any location on the belt holder. The belt holder was designed to allude to ideas of a classic wild-west sheriff or 'gunslinger'. Although this design feature detracts from the concept's usability it does however increase the consumer desirability of the radio.

See Appendix 01 for 'Gunslinger' for concept short film

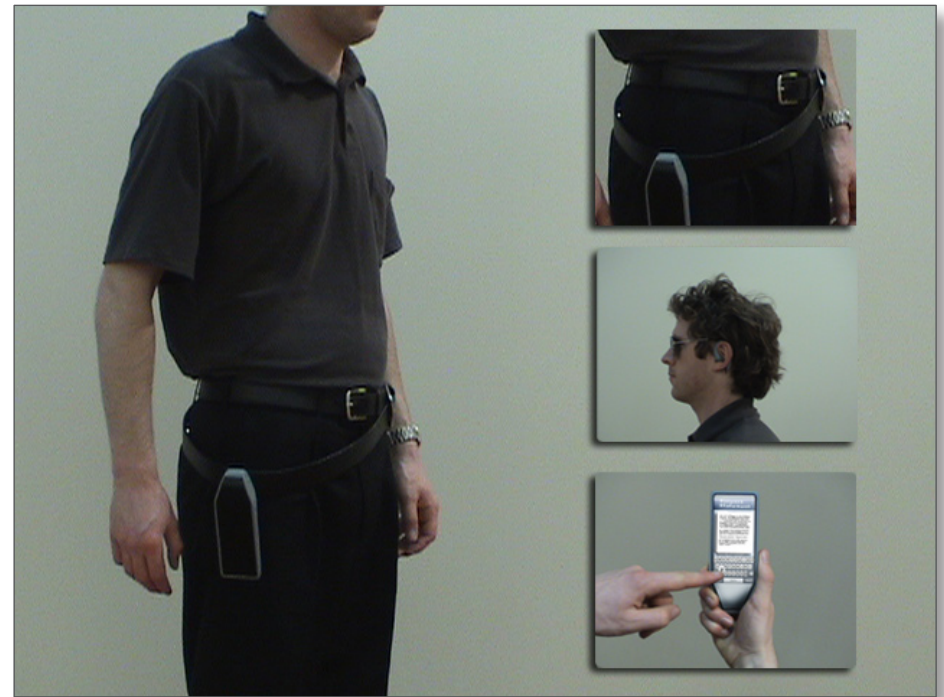


Figure 6.4: Sustainability Hero Image

6.2 - Big Brother

Big Brother

A substantial increase in petty crime has prompted the NZgovernment to install a vast network of CCTV (closed-circuit televisions) and other surveillance systems in public areas. This 'big brother' scheme has altered how the police operate. To increase the transparency of the NZ justice system, officers are required to carry a device that independently records their encounters with the public. A modest tactile interface is utilized to reduce time spent operating their communication device.

Product Stream B - "Big Brother"

- High usability
- Practicality
- Safe
- Reliable
- Conservative

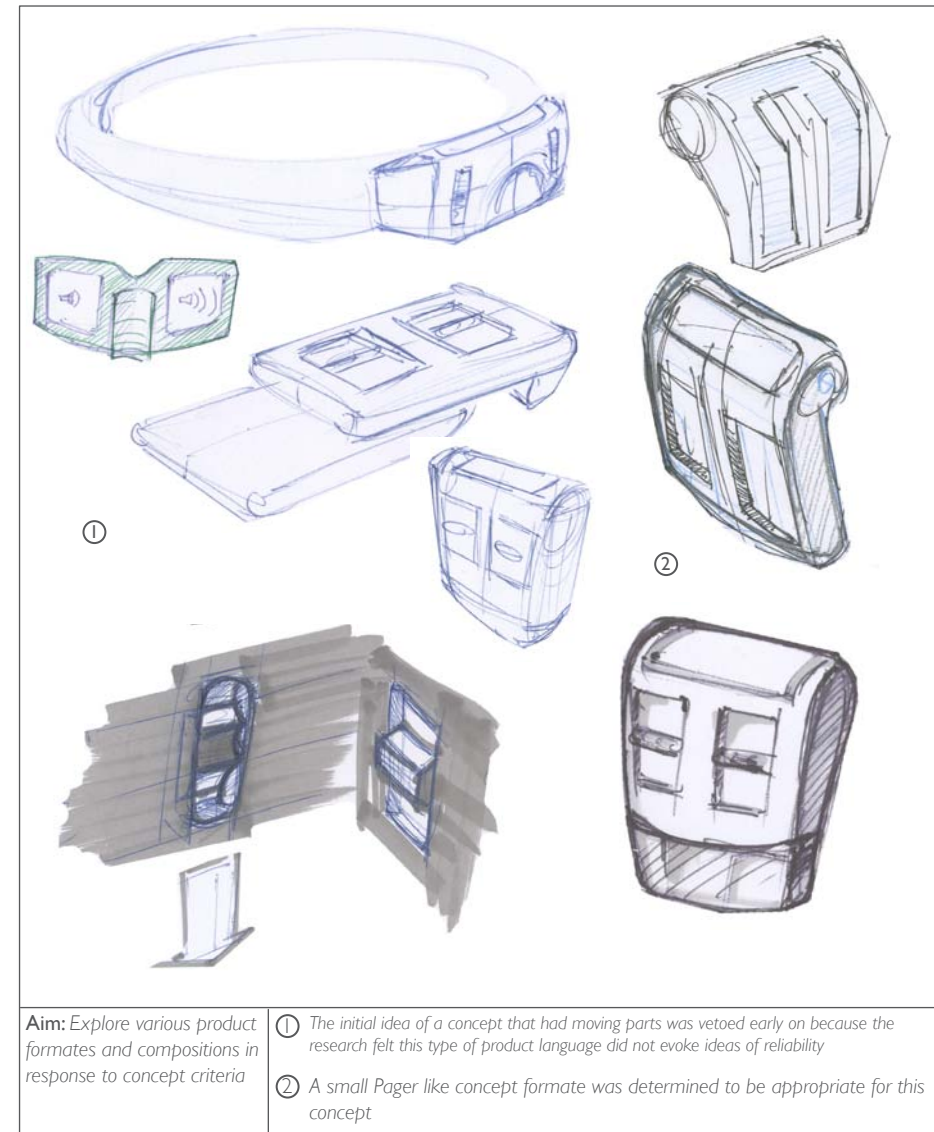


Figure 6.5: Big Brother Early Ideation

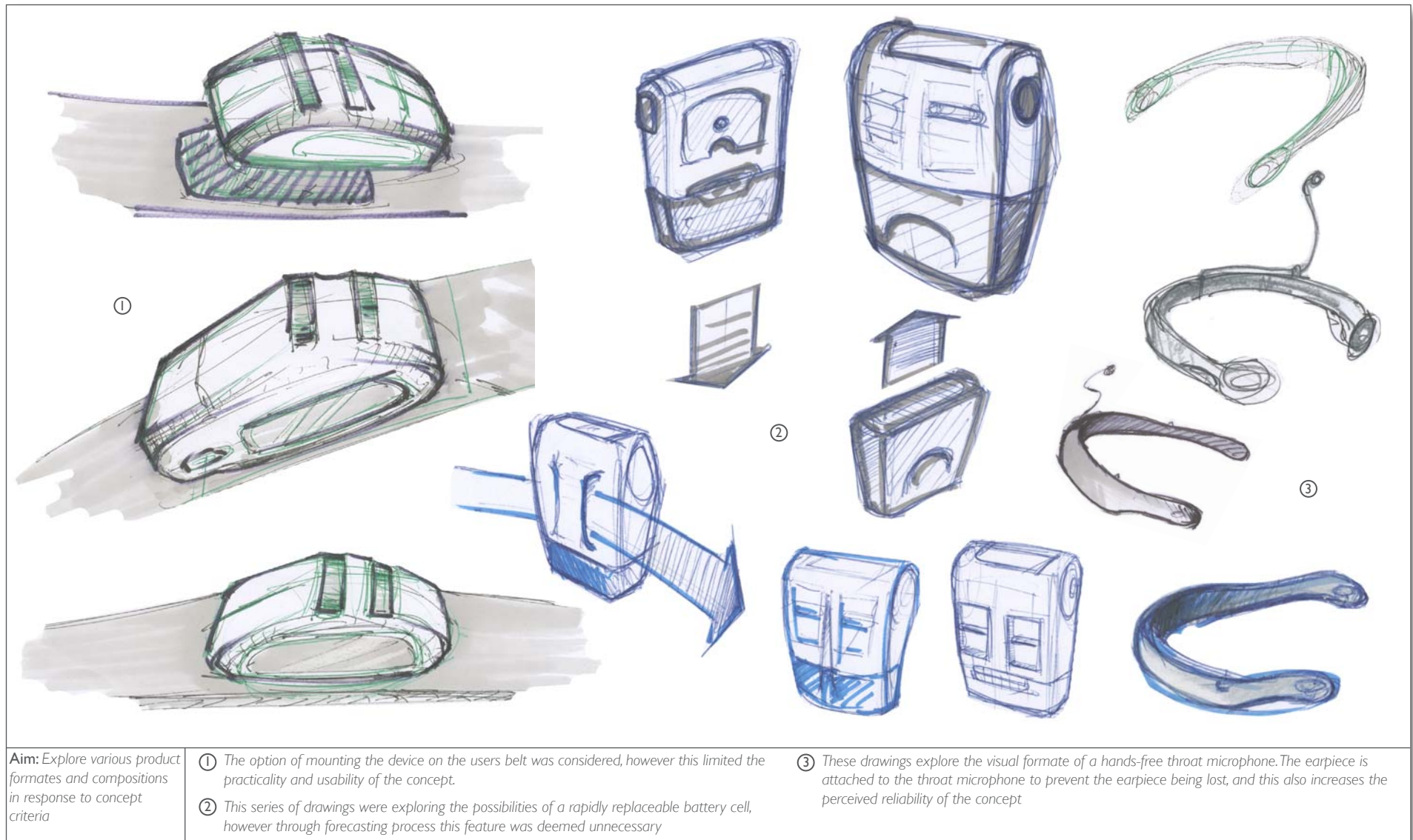


Figure 6.6: Big Brother 2D Sketching

Aim: Through 3D media explore product compositions, grip and weight

Through iterative form studies multiple concept designs were explored. These form studies explored various control function layouts.

- A tactile interface that involved protruding knobs or switches were not chosen for use in this concept because of the possibility of the user accidentally catching these knobs on something.

- It was determined to increase reliability and simplicity of use the concept that two individual control interfaces should be used, as apposed to the one adjustable screen.

- The need for some kind of display interface was eliminated in favour for a largely audio interface.



Figure 6.7: Big Brother 3D Form Studies

6.2 - Big Brother

Concept two consists of two components:

- A throat microphone and earpiece
- The tactile radio base unit

The earpiece is attached to radios earpiece is attached to the throat microphone. The throat microphone is a reliable means of communication. The audio setting of the radio reduces background and provides clear communication.

The radio is designed with no visual interface. Instead information about channel selection and audio volume is audibly communicated to the user. This concept is designed to provide a purely tactile means of interacting with the communication product. The surface texture of the radio is separated distinctive to increase the tactile sensation and differentiation between the interfaces at the radios protective shell. The radio's settings can be locked through the use of a simple voice command. This is done to prevent accidental operation or adjustment of the radios settings.

See Appendix 01 for 'Big Brother' for concept short film



Figure 6.8: Sustainability Hero Image

6.3 - Safety

Safety

After an escalation in armed violent crime the NZ Police have been forced to militarise their on-the-beat personnel. To deter crime all the equipment used by the NZ Police is aesthetically aggressive and designed to evoke strength and unity among officers. Police have been equipped with firearms and are required to be in constant contact with police comms for the duration of their shift. To effectively and safely operate their firearms the police employ a hands-free communication product.

Product Stream C - "Safety"

- Toughness
- Robustness
- Powerful
- Rugged
- Reliability

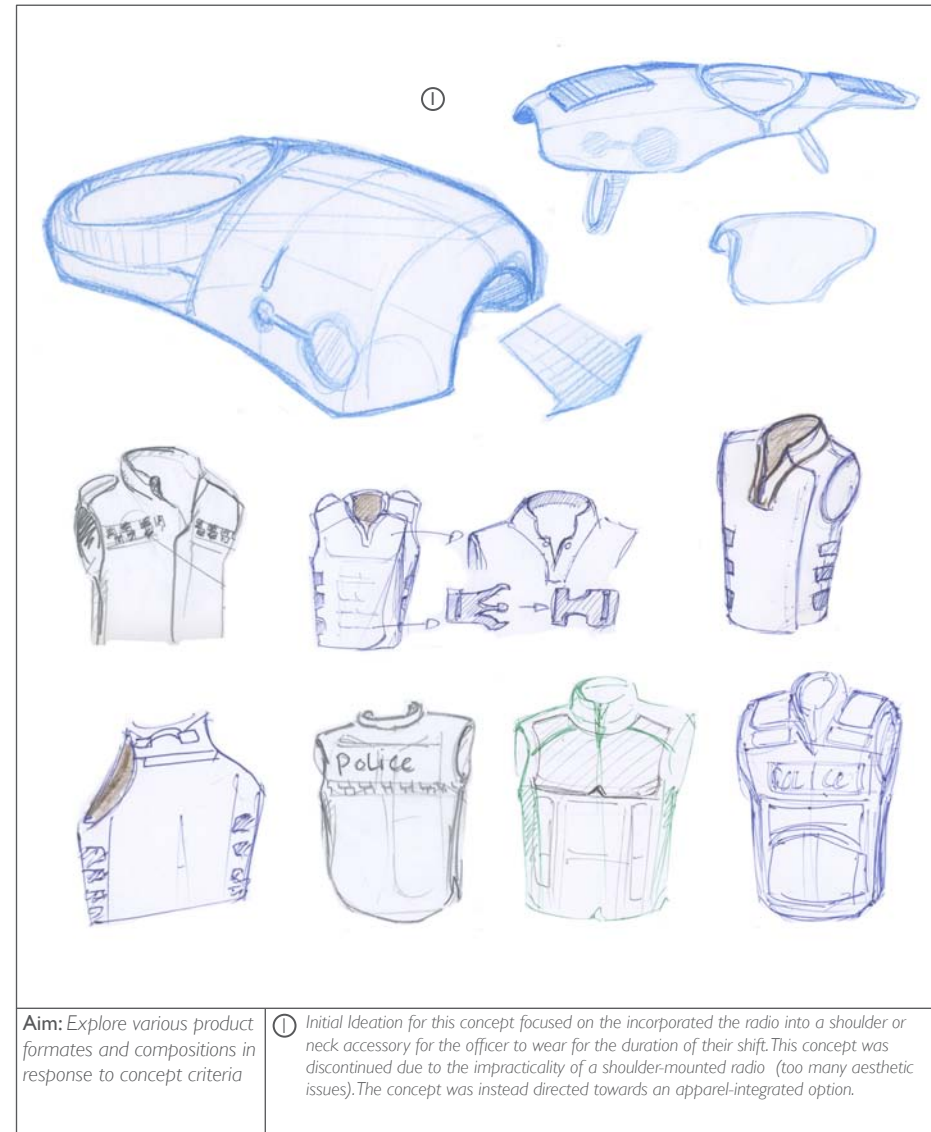


Figure 6.9 Safety Early Ideation



Figure 6.10: Big Safety 2D Sketching



Figure 6.11: Safety 3D Form Studies

6.3 - Safety

Concept three integrates a communication product into a protective vest.

The radio contains a standard ear-bug earpiece that is incorporated into the collar of the vest. Volume and channel control and selections are controlled though a verbal interface. The audio settings automatically adjust according to the spatial conditions of the users environment.

The radios microphone is situated on the collar lapel. This location was selected because it gives the user the ability to use this product in conjunction with other apparel, such as a raincoat.

A central product feature of this concept is that the officer is in direct communication contact with comms for the duration of their shift; this is done to increase the safety of the user. This radio concept contains no visual interface; it is instead completely reliant on audio means of communication.

The concept is also designed to give the user maximum hands-free ability and superior mobility when compared to non-apparel integrated communication solutions.

See Appendix 01 for 'Safety' for concept short film



Figure 6.12: Safety Hero Image

6.4 - Sustainability

Sustainability

As part of an international movement to make all conventional practices more sustainable the NZ Police have been instructed by the government to only purchase environmentally responsible equipment. This focus on sustainability extends to social responsibilities (to be proactive in dealing with issues of environmental concern) as well. As the police are required to enforce strict environmental regulations, communication devices are equipped with a tool that calculates energy overuse and resource expenditure.

Product Stream D - "Sustainable"

- Dynamic
- Innovative
- X-factor
- State-of-the-art
- Intuitive product design

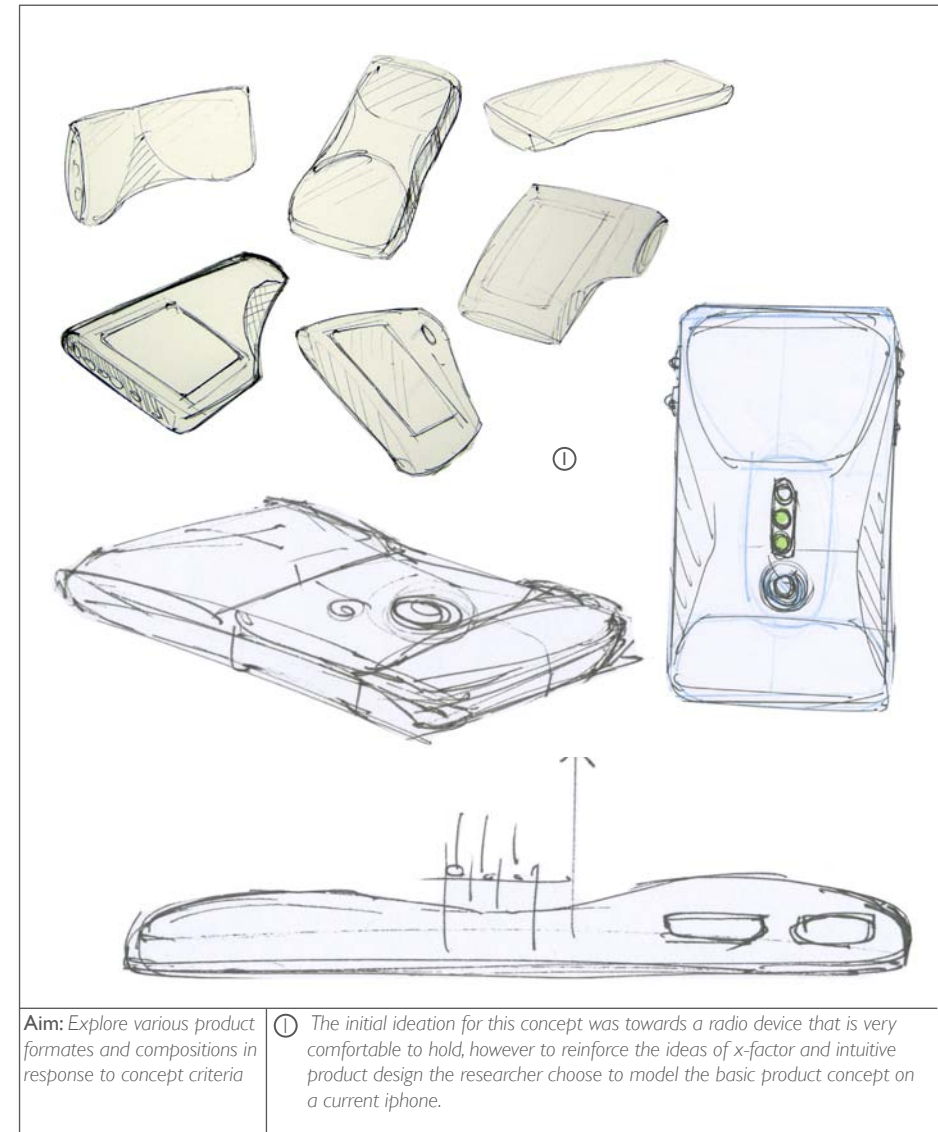


Figure 6.13 Sustainability Early Ideation

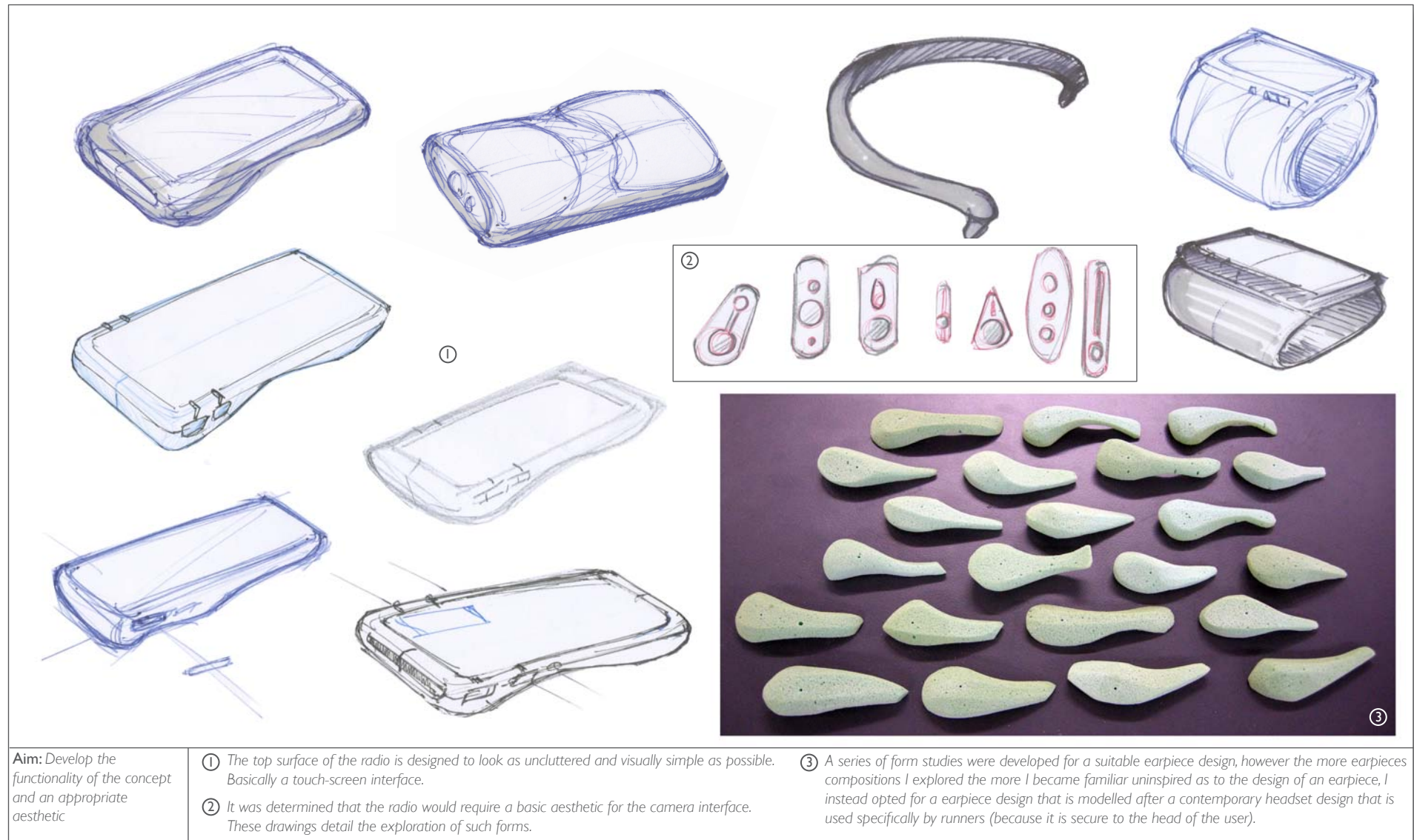


Figure 6.14: Sustainability 2D Sketching



Figure 6.15: Sustainability 3D Form Studies

6.4 - Sustainability

Concept four consists of three components:

- A wireless headset
- Touch-screen radio unit with a built in camera
- The arm holder

The radios headset or 'audio halo' is designed to be ergonomically comfortable and reliable. The driving idea being this audio design is to provide a reliable wireless audio feature that will not easily fall off the head or get lost. The audio headset is designed to be un-obtrusive. Sound waves are directed towards the eardrums so to not block of the users audio sensors.

The radio unit has a camera incorporated into the design. Using this camera function the officer is able to rapidly identify an individual (through the use of facial recognition software). Once Identified the officer then has the ability to view the individuals police database file (if they have one).

As defined in the Scenario for this concept the radio can be used to measure energy and resource expenditure the officer uses the built-in camera to visual scan and identifies relevant information about the amount of energy or resources used by an individual or an object.

When the radio's identification and resources expenditure functions are not being used the radio is stored on the users arm. The location for the device was selected because it provides an alternative body position to what is otherwise available.

See Appendix 01 for 'Sustainability' for concept short film



Figure 6.16: Sustainability Hero Image

7.0 - New Zealand Police Research

The purpose of this section is to:

- Create an understanding into the future requirements of police communication, according to the product's projected users (NZ Police officers).
- Develop a deeper understanding into the affective issues associated with the design of a future police portable radio through the use of the PPE framework (Warell, 2008).
- Evaluate and analyse the four futuristic radio concepts created by the researcher (see section 6.0).

Technologies are not directly discussed; instead, the 'end-goal' of the technologies are discussed. This is done because in ten years' time, the technology available could be very different to today. The research was sourced from twelve general duties NZ Police officers. The officers are anonymous and are not identified at any stage during the research. The information gained from this section was drawn from the following research methods:

- Police policy and legislation interview (see section 4.4.2)
- Police future radio requirements interview (see section 4.4.2)
- Passive product observations (ride-along) (see section 4.4.2)
- Concept analysis (see section 4.4.2)

The views and perspectives gained through this study do not represent the views or opinions of the NZ Police; this is instead a representative sample of officers from an undisclosed NZ Police precinct.

7.1 - NZ Police Future Radio Requirements

This section is an iteration of earlier research conducted with Tait (section 6.2.2) regarding the requirements and desirable functions of a future police portable radio. The information for this section has been categorized into the following headings:

- Emergency function
- Identification
- Non-audio communications
- Officer location
- Operational environment
- Paperwork
- Personal audio
- Privacy of information
- Radio assignment
- Radio energy source
- System design

Emergency functions

There is potential for an emergency function that activates independently according to a series of events, for example: the radio detects the presence of a firearm (using a series of autonomous systems, that detect potential danger to the radio's user, through visual recognition of objects, such as firearms); this would trigger the activation of an emergency function.

Identification

Currently by law (Policing Act, 2008) an individual may be detained for identification “only for the period necessary to take the person’s identifying particulars.” The interviewees indicated that the maximum period is fifteen minutes. Once identified the officer would then check for any reasons to further detain or arrest the individual, for example, an outstanding arrest warrant for breach of curfew.

The future radio design should aim to provide a fast and efficient means of identifying individuals. This identification method(s) should be non-intrusive (as opposed to blood testing, which is intrusive) and should not take more than a few seconds to execute because the current method via audio communication between the officer and comms takes under a minute to execute.

Biometric forms of identification, namely physiological traits (including face, fingerprint, iris and DNA) have a high potential for integration into a future radio product.



Figure 7.1 - Prisoner photography station Source: Researcher

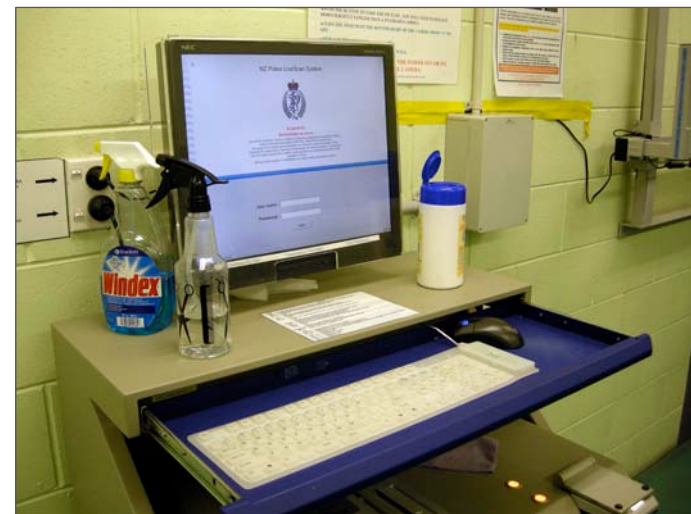


Figure 7.2 - Prisoner thumb printing station Source: Researcher

Non-audio communication

Officers voiced a desire for a product that has the ability to do the following:

- Send and receive suspect information
- Send and receive photographic information and evidence

It was observed that a tactile interface alone would not suffice for a future radio design, because officers were constantly visually checking and re-checking their radio equipment for functionality and status. There is potential for an audio integrated interface e.g.: the status of the radio (audio volume and communication channel selection) is presented audibly.

Officer location

There is a need for a product that has the ability to locate the geographic location of officers. This would include the ability to determine an officer's location according to a street address map as well as the officer's altitude (e.g.: what level of a building). This function would aid in determining the nearest officer(s) to a reported incident.

Operational environment

As mentioned in section 6.2.2, police require maximum product performance and capability in adverse weather and spatial conditions. The future radio design should be able to operate in all spatial and weather conditions imaginable, ranging from extreme cold to extreme heat, and various levels of moisture and visibility.

It was observed that the police are exposed to an array of potentially hazardous, and in some cases explosive atmospheric conditions e.g.: makeshift chemical and drug laboratories. The future radio design should take this into account.

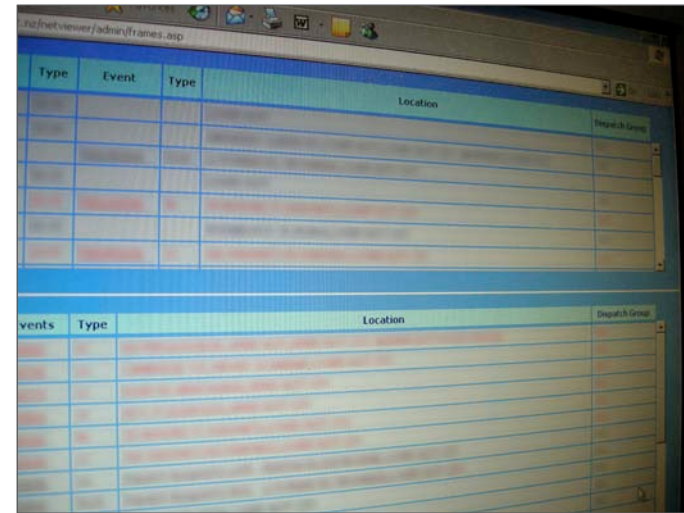


Figure 7.3 - Officer tracking system Source: Researcher



Figure 7.4 - NZ Police patrol vehicle Source: Researcher



Figure 7.5 - Typical Police equipment Source: Researcher

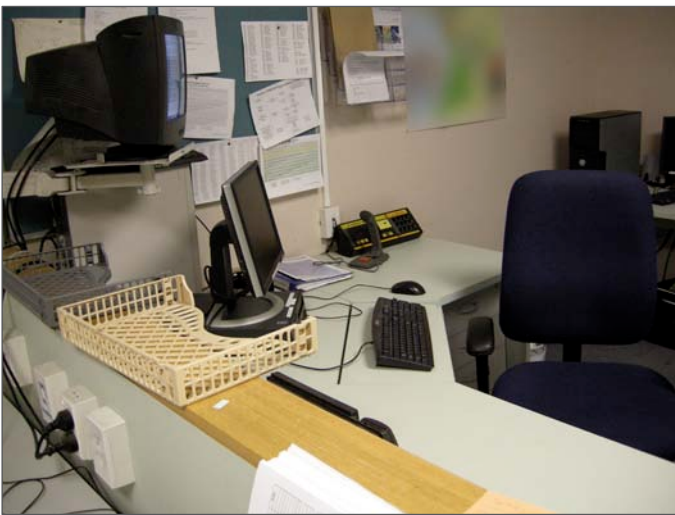


Figure 7.6 - Typical Police workstation Source: Researcher

Paperwork

Currently officers are required to create physical paperwork of every incident and event they attend. For example, when attending a domestic incident a vigorously detailed pre-constructed report is required to be filled out by the attending officer. This paperwork can be time consuming and it can sometimes be hard to communicate an accurate account of the incident/ event. It was also noted that the officer's handwriting is required to be universally legible.

Because the NZ Police are responsible for maintaining law and justice in New Zealand it is a mandate for their file management to be 'fail-safe'. For this reason all incident and chronological event reports are required to be recorded in the following formats:

- Digital (digital text files)
- Physical paperwork

To speed up the incident and event recording process the future radio should be able to sufficiently record information in real-time. One suggested solution is the ability to audibly record and transcribe an events chronology and other relevant information into a transcript. This transcript would be automatically transmitted to an access terminal at the station. At the end of their shift the officers would review all reports created during their shift, make any required amendments, then print the report as well as file a digital copy of the transcript. This would maintain the 'fail-safe' culture required for the NZ Police as well as increase the efficiency and speed of the report formulating process.

Personal audio

Audio accessories (for example, earpieces) are personally issued; this is due to the hygiene requirements associated with audio accessories. The future radio should be hygienic to use.

Officers voiced concerns about potential damage to their hearing from prolonged earpiece use. The future radio should autonomously adjust its audio settings according to its surroundings.

Privacy of information

Currently the police use a series of codes to quickly and efficiently communicate to each other while maintaining a level of privacy. For example, when an officer is inquiring about a suspect, the officer would communicate with the dispatcher at comms as to what specific information they desire. If the information is deemed inappropriate to be communicated while the officer is in the presence of the suspect the dispatcher would reply “your query has a current flag”.

This exemplifies the need for police communications to be private and in some cases coded; the future radio and system design should be designed with this requirement in mind.



Figure 7.7 - Officer wearing a speaker/microphone Source: Researcher

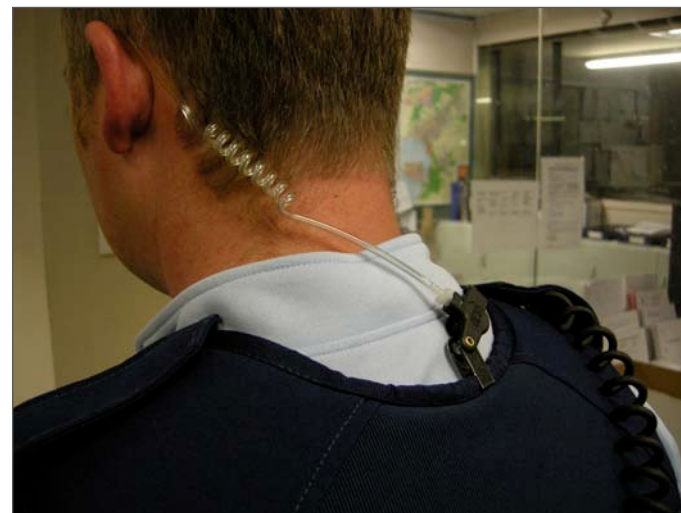


Figure 7.8 - Officer wearing a personal audio earpiece Source: Researcher



Figure 7.9 -Typical equipment and keys cabinet Source: Researcher



Figure 7.10 -Radio battery charge stations Source: Researcher

Radio assignment

Officers desire a radio that is 'personally issued' (see section 3.3.2); this would enable officers to personalise their radio's functions and settings, including audio settings, body position and operational functions. It was observed that there is a tactical and management advantage in a radio that is 'group issued' (see section 3.3.2), especially for one-off events such as music festivals. The future radio design should be flexible enough to be issued in both radio assignment scenarios.

Radio energy source

Some officers carry an additional battery during their shifts, however this is not a required practice. Currently radios are purchased with two batteries; ideally one is in use while the other is being charged. The future radio's power source should have the ability to be replenished in the fastest and most efficient manner possible, potentially to eliminate the need for a secondary battery. There is potential for kinetic charging ability, for example from movement.

System design

The police precinct that took part in this study had a secondary communication channel for 'spill over' when the main communication channel is too busy. This additional channel is rarely used and is seen as a 'fail-safe' precaution. The future radio system design should be able to expand and contract in capacity according to demand.

7.2 - NZ Police Requirement Design Criteria

Performance Criteria	Required	Desirable (High)	Desirable (Moderate)	Desirable (Low)
Efficient and fast method(s) for identifying an individual		<input type="radio"/>		
Ability to record, transcribe and retain audible and visual data		<input type="radio"/>		
Ability to send and receive photographic files (still and video) over a secure network, only accessible by authorised personnel			<input type="radio"/>	
'Fail-safe' operation (back-up system design)	<input type="radio"/>			
Private, secure and encrypted system design	<input type="radio"/>			
Ability to communicate an officer's geographic location to all officers on the system, as well as comms		<input type="radio"/>		
Ability to operate in adverse weather and spatial conditions network, only accessible by authorised personnel	<input type="radio"/>			
Rapidly replenishable energy source		<input type="radio"/>		

Table 7.1: NZ Police Requirement Design Criteria

7.2 - NZ Police requirement design criteria

Performance Criteria	Required	Desirable (High)	Desirable (Moderate)	Desirable (Low)
Autonomous emergency system		○		
Flexible system design that is able to expand and contract in user-system capacity according to network demand, only accessible by authorised personnel	○			
Ability to function in both types of radio assignment scenarios (group and personal issue, see section 3.3) network, only accessible by authorised personnel	○			
Multiple audio options to accommodate officer's personal preferences			○	
Experience Criteria	Required	Desirable (High)	Desirable (Moderate)	Desirable (Low)
Identification function(s) should be un-obtrusive			○	
Identification function(s) should be easy to operate		○		
Replenishment of the radio's energy source should be easy and uncomplicated		○		
Emergency function should be activated deliberately, not by accident		○		

Table 7.1: NZ Police Requirement Design Criteria

7.3 - NZ Police PPE Framework Analysis

The purpose of this section is to develop a deeper understanding of the affective issues associated with the design of a future police portable radio. To do this the three dimensions of the representation mode (see section 3.1.2) of the PPE framework (Warell, 2008) have been used. This includes:

- Recognition
- Comprehension
- Association

The presentation dimension (see section 3.1.2) of the PPE framework (Warell, 2008) and its sub-modes (impression, appreciation and emotion) are not used in this aspect of the study because the presentation dimension of the PPE is concerned with the non-interpretative side of a product experience, directly related to how the product is experienced “for what it is” (Warell, 2008, p. 8).

The results of the application of the representation mode of the PPE framework are detailed in this section:

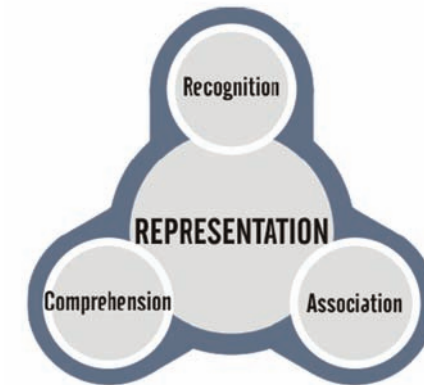


Table 7.11: PPE (Warell, 2008)



Figure 7.12 - Tait TP 9100 Police portable radio Source: Tait Image data base

7.3.1 - Current Product Recognition

The aim of this section was to create an understanding of how successful/unsuccessful the Tait brand has been communicated through the design of Tait's current police portable radio. Through analysis of the Tait brand (see section 6.2.1) using the PPE framework three main brand values or "design cues" (Warell, 2008, p. 11) for a Tait product were deciphered. They were: robustness, reliability and professionalism.

To determine how successful/unsuccessful these brand values have been embodied in the design of the radio, officers were asked to rate on a scale of one to seven (one being the lowest and seven being the highest) "how the product 'is' (like)" (Warell, 2008, p. 11) according to their personal preference. An additional three words associated with the design of a future product were added to the set of words for testing: high-tech, usable and modern.

Tables 7.2-7.7 describe the example product's (see figure 7.12) lack of strength at communicating the design cues of 'modernness' and being 'high-tech'. It is noted that these design cues are not part of the Tait brand (see section 6.2.1); however, they are prerequisite when designing a product for the future.

This section highlights the relative success of the Tait TP 9100 at communicating the desired brand values and design cues of the Tait brand and emphasizes the need for these values to be applied and enhanced in a future radio designs.

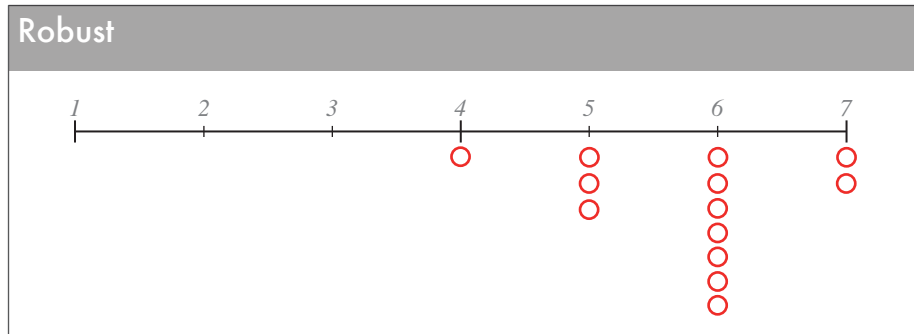


Table 7.2: Robust

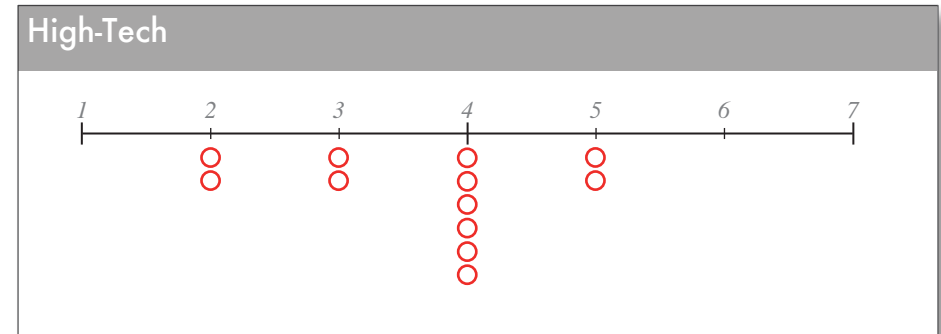


Table 7.3: High-Tech

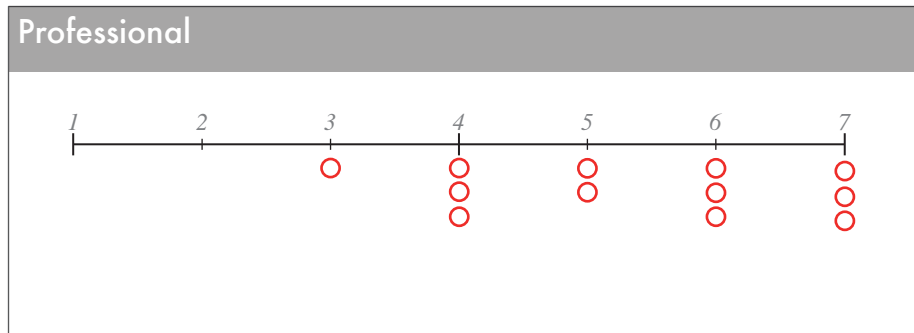


Table 7.4: Professional

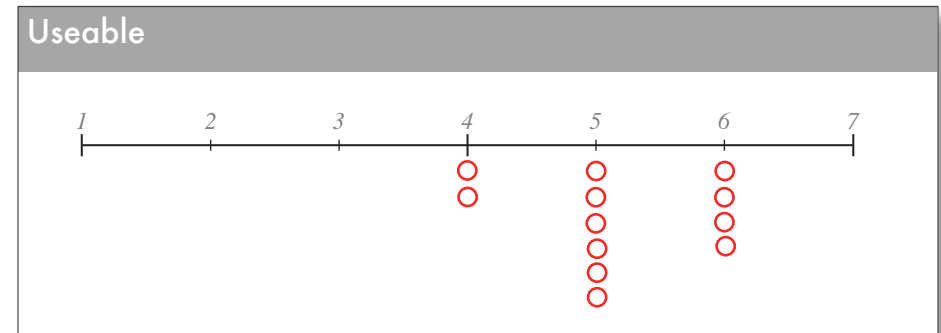


Table 7.5 Usable

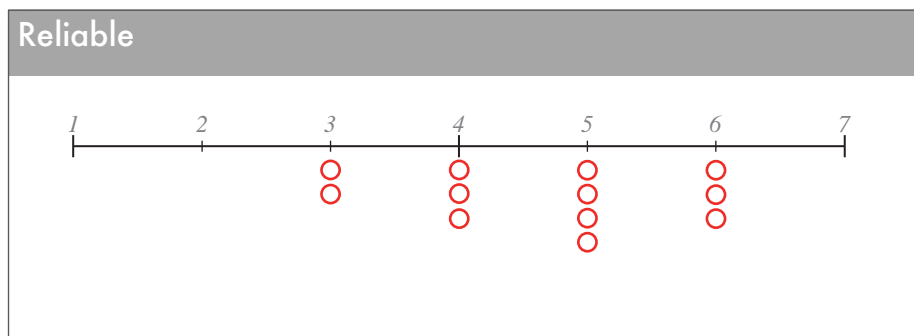


Table 7.6 Reliable

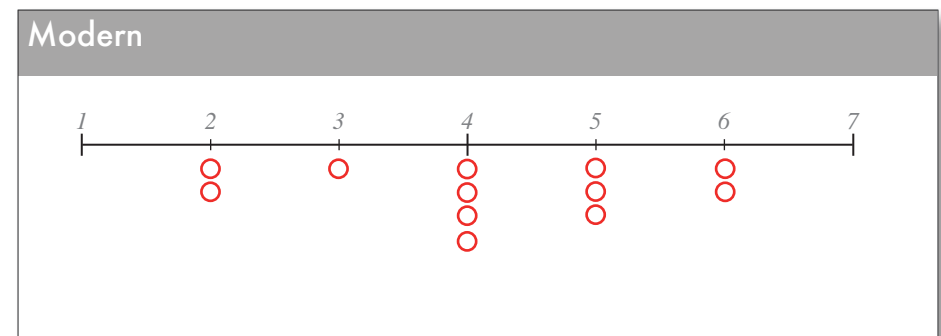


Table 7.7 Modern

7.3.2 - Police Radio Comprehension

To determine how police portable radios are comprehended - i.e. “what people understand” (Warell, 2008, p. 12) (see section 3.1.2) - participants were asked to describe and/or circle on a sample product image (see figure 7.13) what features (visually) they consider to be ‘symbolic signs’ (Warell, 2008) that determine a radio to specifically be a portable police radio. The following aspects were most common among responses:

- 01 - Antenna
- 02 - Channel knob
- 03 - Tilted volume knob
- 04 - Speaker/microphone
- 05 - PTT (Push-to-talk)
- 06 - Protected screen
- 07 - Visually strong
- 08 - Black/formal colouring

(See figure 7.13)

As mentioned in sections 6.2 and 7.2, current technologies are not being identified in this study, instead the ‘end goals’ of the technologies. This being established, figure reference numbers 01,02,03,04,05 and 06 (see figure 7.13) are all based on the product’s performance, namely the technology of the product, so they are not relevant to this investigation. Figure reference numbers 07 and 08 (see figure 7.13) are experience based in concept, so these aspects of comprehension of the radio are relevant to this study. To be comprehended (Warell, 2008) as a portable police radio the future product should be visually coloured in a formal manner, potentially black, and should be visually strong in product design, composition and proportion.



Figure 7.13 - Example Police portable radio Source: Researcher

7.4.3 - Product Association

The intent of this section is to develop an understanding of the associative design requirements - “what the product stands for” (Warell, 2008, p. 12)
- for a future portable police radio.

To do this four ‘product streams’ were developed. Each product stream consists of the following: a vehicle, a cell phone and one of the four concepts created in section 6.0. Each member of a product stream was selected because of similarities in the product messages being communicated. For example: the vehicle, cell phone and radio concept in product stream 01 (see figure 000-000) have the following traits in common:

- Performance driven
- Consumer desirability
- Advanced technology
- Aesthetic flair
- Sleekness

Vehicles are used as part of the product streams because as products they are heavily designed to embody iconic signs and branding (for example, the Hummer in figure 000 embodies ideas of strength and robustness). Cell phones are used because they are similar in product design and functionality to portable radios.

For this section officers were asked to determine which of the vehicles they would choose to use for their job as a NZ Police officer. Officers were then asked to bullet-point the positive and negative aspects of each vehicle in context to their job. The results were subsequently categorized into performance and experience components. The same line of questions was then applied to the cell phone aspects of the product streams. The concepts created in section 6.0 are analysed later in this section.

Officers were not presented with products (vehicles and cell phones) that would meet all their needs and requirements. Instead, officers are presented with four extremes in product aesthetics and design to choose from. The aim is to seek out what aspects of each of the product stream products (vehicles and cell phones) are desirable or important to the NZ Police officers taking part in this study. Through this method officers quantify what the appropriate product associations are for a future police portable radio.

Product Stream A - “Gunslinger”

- Performance driven
- Consumer desirability
- Advanced technology
- Aesthetic flair
- Sleekness

Table 7.8 -Gunslinger Product Associations

Product Stream B - “Big Brother”

- High usability
- Practicality
- Safe
- Reliable
- Conservative

Table 7.9 - Gunslinger Product Associations



Figure 7.14 - Lamborghini Gallardo SuperLeggera



Figure 7.15 - Volvo 170



Figure 7.15 - Motorola Razor Max V6 ferrari



Figure 7.16 - Nokia 5140i



Figure 7.18 Gunslinger Hero Image



Figure 7.19 - Big Brother Hero Image

Product Stream C - "Safety"

- Toughness
- Robustness
- Powerful
- Rugged
- Reliability

Table 7.12 - Safety Product Associations

Product Stream D - "Sustainable"

- Dynamic
- Innovative
- X-factor
- State-of-the-art
- Intuitive product design

Table 7.13 - Sustainable



Figure 7.20 - Hummer

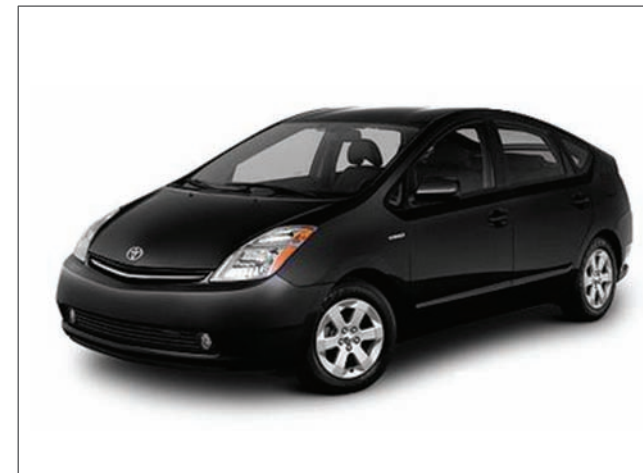


Figure 7.21 - Toyota Prius



Figure 7.22 - AK47 Cell Phone



Figure 7.24 - Safety Hero Image



Figure 7.23 - Apple iphone



Figure 7.25 - Sustainable Hero Image

7.3.4 - Vehicle Association Analysis




Vehicle	Performance		Experience	
	+	-	+	-
	<ul style="list-style-type: none"> - Fast vehicle - Vehicle performance and handling 	<ul style="list-style-type: none"> - Expensive to run and maintain - Lack of versatility for use 	<ul style="list-style-type: none"> - Desirable vehicle 	<ul style="list-style-type: none"> - Specialist driver training required for operation - An inappropriate use of government resources
	<ul style="list-style-type: none"> - Good storage capacity - Comfortable for long periods of time 	<ul style="list-style-type: none"> - Slow speed, bad for pursuits - Questionable handling - Imported vehicle means potentially more expensive to repair and service 	<ul style="list-style-type: none"> - Robust - Strong - Practical - Safe for driver and the occupants - Versatile vehicle design - Efficient use of resources 	<ul style="list-style-type: none"> - Boring to drive - Ultraconservative
	<ul style="list-style-type: none"> - Robust structure - Reliability - Utility (storage capacity) 	<ul style="list-style-type: none"> - Equipment load ability - Not fast enough for vehicle pursuits - Economically unviable - Lack of manoeuvrability 	<ul style="list-style-type: none"> - Aggressive aesthetic - Tough aesthetic - Strong aesthetic - Robust aesthetic 	<ul style="list-style-type: none"> - Intimidating paramilitary look - Aggressive aesthetic - Lack of stealth ability
	<ul style="list-style-type: none"> - Cost efficient to run 	<ul style="list-style-type: none"> - Lack of speed - Handling - Manoeuvrability - Impractical load capacity - Not robust enough 	<ul style="list-style-type: none"> - Environmentally conscious - 'Green image' - Perception of safety 	<ul style="list-style-type: none"> - Weak public image for police

Table 7.14 - Vehicle Recognition Analysis

7.3.5 - Vehicle Association Results

Officers were asked to identify their personal preference among the four vehicles presented. Officers were asked to identify out of the four vehicles presented which they would choose to use for their job as a NZ Police officer. Officers were then asked to determine the positive and negative aspects of each vehicle according to its appropriateness for use by the NZ Police. The results were then categorized into performance and experience components (see table 7.14).

83% of officers questioned stated that of the four vehicles present they would choose to use vehicle B for their job. This was due to the products perceived robust 'nature' and high level of performance and utility. The remaining percentage choose vehicle C, because of the products durability and robustness (see table 7.15).

In an abstract sense the following qualities are desirable in a vehicle design for the NZ Police:

- A high level of handling and performance
- Durability
- Robustness
- Reliability
- Utility
- A responsible use of resources

These qualities can be similarly applied to the requirements of a future police portable radio design in the form of product association requirements.

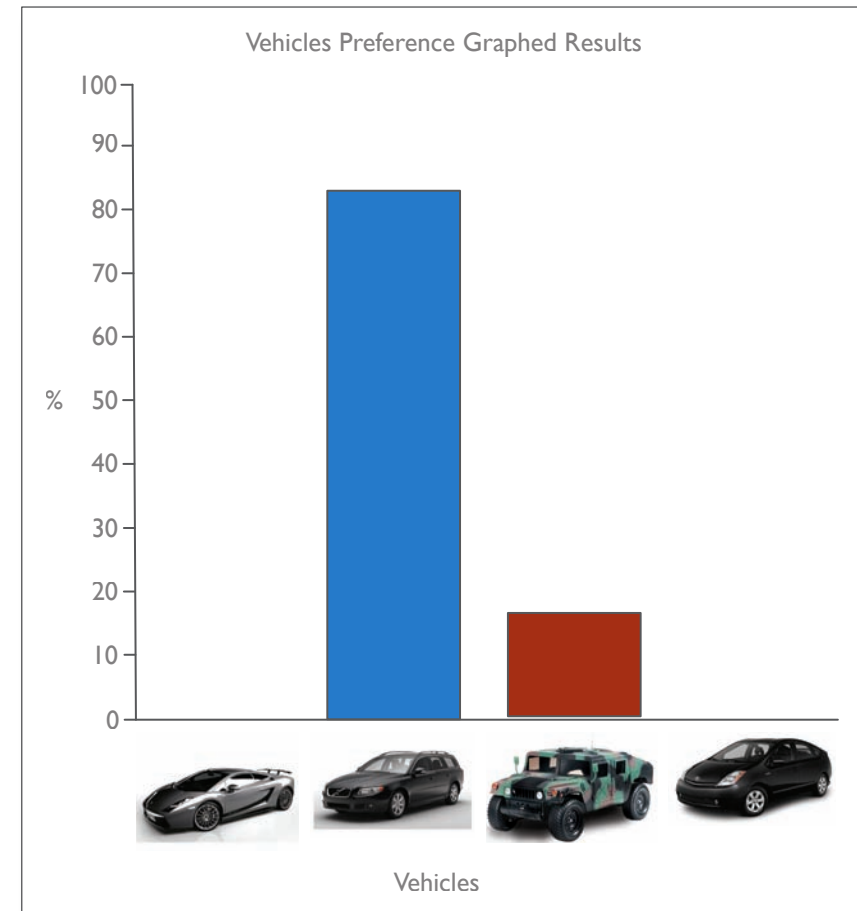


Table 7.15 - Vehicle Recognition Analysis Graph

7.3.6 - Cell Phone Association Analysis

Cell Phones	Performance		Experience	
	+	-	+	-
	<ul style="list-style-type: none"> - Compact - Thin - Small - Lightweight 	<ul style="list-style-type: none"> - Flimsy hinge - Not robust enough - Difficult to press buttons - Materiality 	<ul style="list-style-type: none"> - Portable - Clean lines 	<ul style="list-style-type: none"> - Opening and closing
	<ul style="list-style-type: none"> - Small - Compact - Robust - Simple functionality 	<ul style="list-style-type: none"> - Small screen - Lack of camera, both video and still - Limited capabilities 	<ul style="list-style-type: none"> - Simplicity of use - Reliability 	
	<ul style="list-style-type: none"> - Rugged - Durable - Functionality 	<ul style="list-style-type: none"> - Bulky size - Not portable enough - Weight - Shape 		<ul style="list-style-type: none"> - Ugly aesthetic
	<ul style="list-style-type: none"> - Potential for Internet use - Thin - Lightweight - Small - Touch screen - Camera 	<ul style="list-style-type: none"> - Lack of robustness 	<ul style="list-style-type: none"> - Additional functionality from touch screen 	<ul style="list-style-type: none"> - Too flashy and distracting - Too expensive - Extensive training required for effective use

Table 7.16 - Cell Phone Recognition Analysis

7.5.7 - Cell Phone Association Results

Officers were asked the same series of questions as previously asked about their preferred vehicle to use (see section 7.3.4). 70% of the officers stated they would prefer to use cell phone option B (see table 7.15) because of the perceived robustness, reliability and simple operation. The remaining 30% opted to use cell phone D, because of the additional functionality and versatility presented, e.g.: mobile computing and mobile connection to the Internet.

The following qualities were identified to be desirable in a cell phone being used by a NZ Police officer:

- An easy to understand interface
- Robustness
- Reliability
- Utility
- Cost effectiveness

In addition to these qualities being identified as desirable in police equipment, the officers' openness to new technologies and non-traditional product formats was also discovered, as represented in cell phone D. as well as a desire for a radio that has an increased functionality beyond audio ability. Cost effectiveness was mentioned because currently cell phones are not designed to be very robust and replacement costs can be expensive.

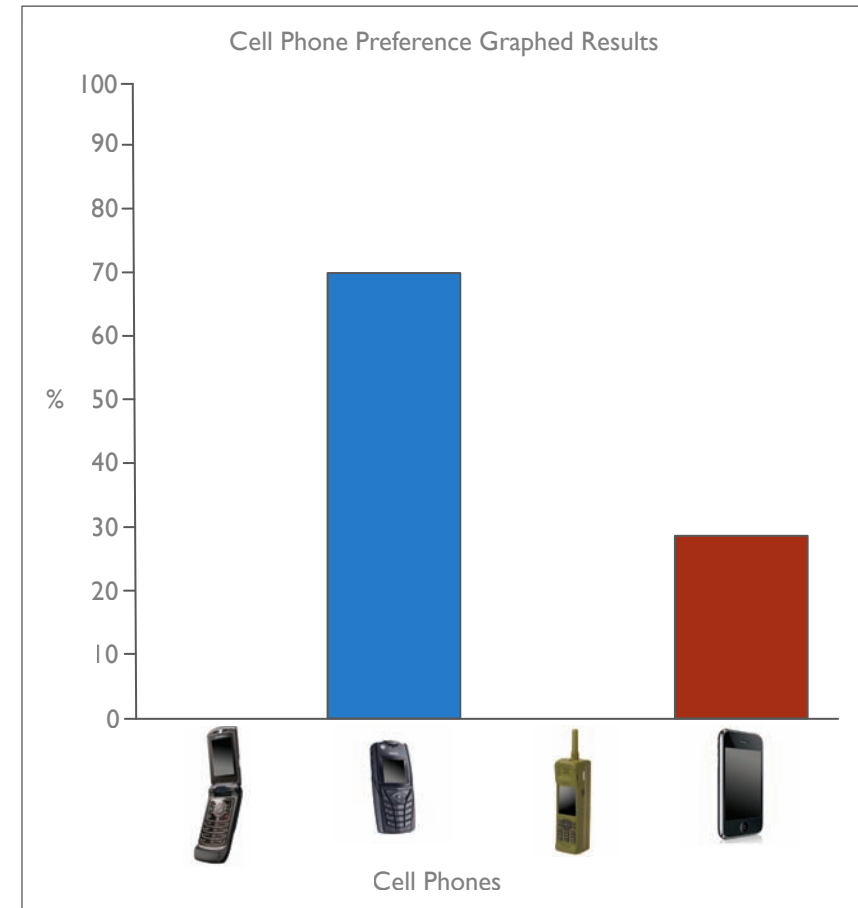


Table 7.17 - Cell Phone Recognition Analysis Graph

7.4 - NZ Police PPE Framework Summary

No performance design criteria were created through the insight gained from this section; instead, this section focused on the representation dimension of the PPE framework (see section 3.1), which relates to understanding the product experience as a “meaning-making phenomenon” (Warell, 2008, p. 10).










Experience Criteria	Required	Desirable (High)	Desirable (Moderate)	Desirable (Low)
The future radio should:				
- evoke ideas of reliability				
- evoke ideas of robustness				
- evoke ideas of durability				
- have a high level of utility				
- be formal in colouration				
- look like a professional product (not like a toy)				
- be visually strong in proportion, composition and overall product design				
- be a responsible use of resources, through material selection and product construction				
- have an interface that is easy to use and understand				

Table 7.18 - Police PPE Analysis Design Criteria

7.5 - Concept Analysis

The aim of this section is to evaluate the four concepts created by the researcher in section 6.0. Each concept was presented through two methods:

- 1) A short video that introduces the concept: context, functionality and the corresponding scenario (see section 6.0). The purpose of this was to present each concept without conflict of interests, e.g.: the researcher's personal opinion (see appendix 01).
- 2) Hard model presentation of the concept, to communicate the concept's intended physical features: including size, weight and texture.

Officers were asked to list the positive and negative aspects of each concept, as well as suggest ways to improve the functionality and appropriateness of each concept. As in previous sections the results were subsequently categorized under performance and experience headings.

Once all the concepts had been analysed, officers were asked to rank their preference of concepts from two perspectives: their professional preference and their personal preference.

Gunslinger

Main radio

Participants were very receptive to the weight, shape and form of the concept. Officers liked the additional functionality of the touch-screen interface and the thumbprint identification tool. There were doubts about the robustness and appropriateness of the touch-screen interface. Officers suggested the user thumbprint identification tool could be used to not only identify the radio user but also to identify potential suspects.

The inclusion of a camera (still and video) was discussed as being very favourable. The camera would be used for collection and storage of information; officers also desired a faster and easier means of interfacing with the device, such as a stylus.

Attachment belt

Officers unanimously did not like the belt aspect of the concept; they felt it to be impractical and inappropriate for the job. By their own admission officers are carrying too much equipment on their belts, also the belt was not perceived to be very secure to the body and in turn inappropriate for on-foot suspect pursuits and other day-to-day operations.

Wireless rarpiece

Officers liked the wireless earpiece; they liked the size and weight of it. Officers especially liked the wireless aspect of the design.

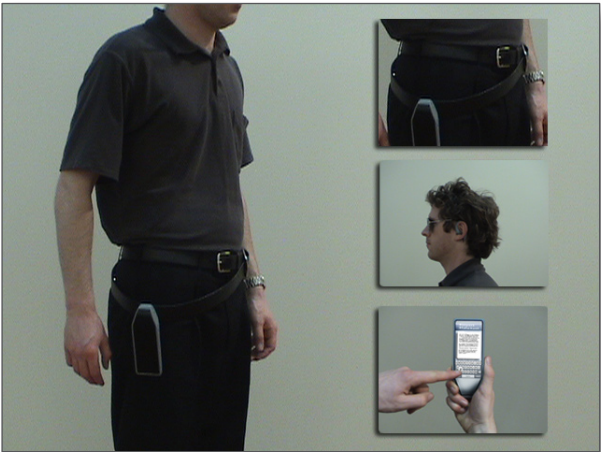


Figure 7.26 - Gunslinger Hero Image

	Performance	Experience
+	<ul style="list-style-type: none">- Touch-screen interface- Colour screen interface- Thumbprint identification, for user and suspects- Event logs for individuals and street addresses- Wireless earpiece	<ul style="list-style-type: none">- Compact- Portable- Product composition and format- Shape of concept
-	<ul style="list-style-type: none">- Belt- Location on body	<ul style="list-style-type: none">- Not robust looking

Table 7.19 - Gunslinger Analysis

Big Brother

Main radio unit

The size and weight of the radio was considered good, however concerns over the lack of functionality and interface were described as major design flaws. The product also lacks consideration for extreme weather conditions, especially relating to situations when officers are required to wear their protective gloves; the tactile interface would be difficult to use at best.

The audio recording feature was seen as very desirable. Officers insisted the product should do more than just record audio; it should be able to record audio and visual information. Officers did not feel this recording of their interactions with the public and general duties was an invasion of their space. Officers all felt any way to record what they are doing would be invaluable as a law enforcing tool, as a method to accurately record an incident.

Throat microphone / speaker

The additional audio quality of the throat microphone was seen as a positive feature. Officers felt there were better, more appropriate approaches for the microphone and earpiece features displayed in the other concepts, namely concepts 01 and 04, which feature wireless earpieces.



Figure 7.27 - Big Brother Hero Image

	Performance	Experience
+	<ul style="list-style-type: none"> - Size of product - Weight of product - Tactile interface 	<ul style="list-style-type: none"> - Throat microphone's audio quality - Recording of officers' interactions
-	<ul style="list-style-type: none"> - Earpiece design - Lack of functionality - Lack of interface - Lack of utility 	

Table 7.20 - Big Brother Analysis

Safety

Main unit

Officers were very receptive to the idea of being in constant contact with comms. They felt this would be a positive feature because it would increase the safety of individual officers. Additionally, the hands-free operation of the radio was seen a very positive product attribute.

Officers were very receptive to being issued a radio in the personal issue (see section 3.3.2) scenario. Officers expressed a desire to have their own personal radio issued, so they could personalise the operation and function of their radio to suit their own personal needs and preferences. The lack of functionality of this concept was discussed. Currently the NZ police are only able to use the audio functions of their radios; it is expected that any future NZ Police radio will have multiple options for communication, not just audio.

Earpiece

Officers felt the earpiece design was antiquated.



Figure 7.28 - Safety Hero Image

	Performance	Experience
+	<ul style="list-style-type: none">- Hands-free communication- Personal issue user scenario- Lightweight- Distribution of weight- Associated safety from being hands-free	
-	<ul style="list-style-type: none">- Earpiece design- Single function, not enough product ability- Audio controls are not reliable enough- Lack of practicality- Expensive to replace and repair- Lack of interface- Lack of utility	

Table 7.21 - Safety Analysis

Sustainability

Main radio unit

The suspect identification system was considered a very appropriate addition to the radio's functions. Along with mobile computing the feedback for this concept was similar to Concept 1. The potential for video application (still and moving) was reasserted. Officers desired the main radio unit to have more of a defined form; the potential for this radio concept to fall out of the hand when being used was considered high.

Armband holder

The position on the body was seen as awkward and inappropriate due to the awkward size of the concept and its relation to various individuals' arm sizes. When tried on by some of the larger officers it was deemed acceptable, however some of the smaller in stature officers had trouble keeping the armband and radio in the desired position. Officers also felt that such an important piece of equipment should be closer to the body, as opposed to further away.

Audio halo

The Audio Halo's non-intrusive audio feature was well received, however the shape and format of the halo was seen to be undesirable for some of the research participants. This was due to their lack of hair for the halo to grab onto and the halo's lack of consideration for irregular head shapes.



Figure 7.29 - Sustainability - Hero Image

	Performance	Experience
+	<ul style="list-style-type: none"> - Note taking ability - Suspect identification - Non-intrusive audio - Mobile computing - Visual data collection - Touch-screen interface - Camera function - Product weight 	
-	<ul style="list-style-type: none"> - Audio halo design - Body position - Armband 	<ul style="list-style-type: none"> - Time taking identifying suspect with 4-set light effects

Table 7.22 - Sustainability Analysis

7.6 - Concept Results Analysis

Officers were asked to rank the concepts in order of most desirable to least according to their professional preference - i.e. the most appropriate for their job as NZ Police officer - and their personal preference. The results between professional and personal preference were exactly the same (see figures 7.23).

Table 7.23 shows the ranked professional preference of the four concepts. Concept 01 'Gunslinger' was overwhelmingly the most desired concept, followed by concept 04. Concepts 02 and 03 were both ranked equally

(see table 7.23). It was noted that many officers voiced their preference as being concept 02, however they felt the design was more appropriate to act as an accessory, as opposed to a stand-alone concept. But also as mentioned in the concept analysis, officers were receptive of concept 02's communication system design.

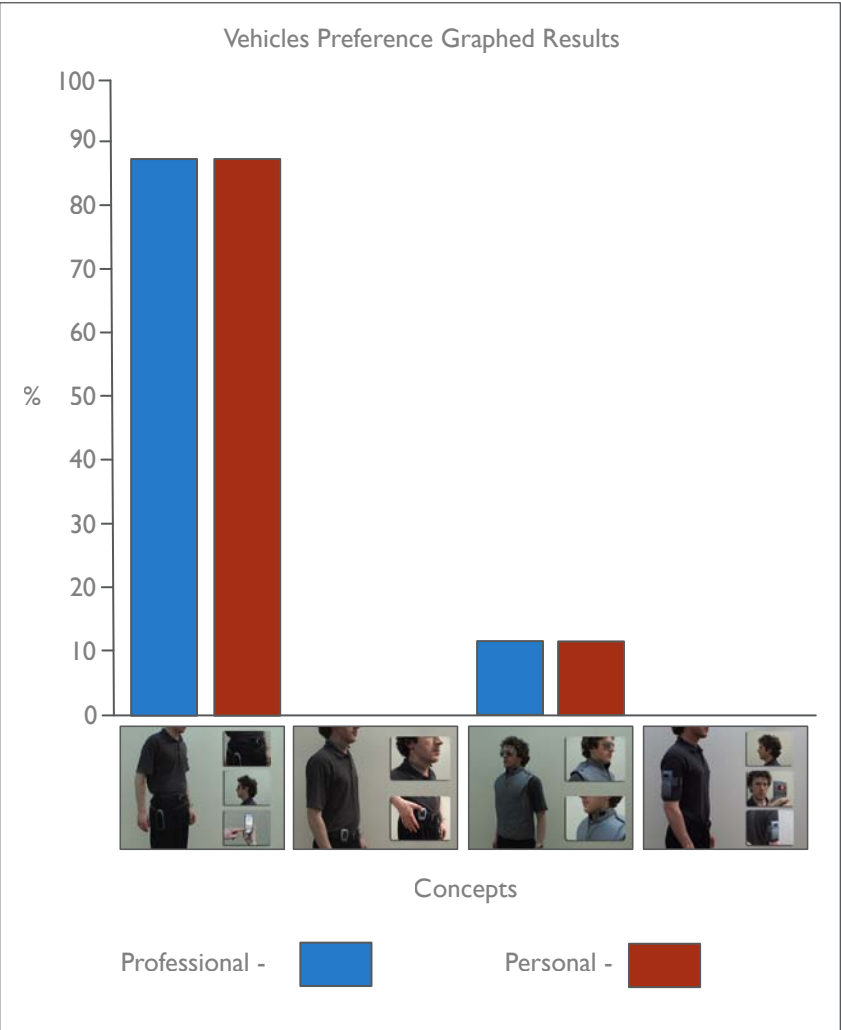


Table 7.23 - User Personal/ Professional Concept preference

7.6.1 - Concept Analysis Summary

The results from the analysis have been categorized into sub-headings and listed below.

Audio options

The future radio should consist of a wireless audio communication system to free-up officers' body movements. The speaker/microphone should be incumbent in the earpiece design. It is also desirable for the audio earpiece to be non-intrusive so it does not hinder the officer's audio senses.

Audio earpieces are required to be a personal object as opposed to communal for hygiene reasons. It is desirable that the future radio design should provide a range of earpiece options according to personal preference.

Body placement

The body placement of the future radio should be on the chest attached to (not integrated with) the officer's police issue protection vest. This is due to an international trend in police equipment being repositioned from the utility belt onto the vest or some kind of carrying harness, because of a large amount of health and safety issues currently associated with carrying equipment on utility belts.

Camera

The integration of a camera into the main radio device is highly desirable. To prosecute an individual for breaking a law a reasonable amount of proof is needed (depending on the seriousness of the crime). Using a digital film camera to record incidents as they happen would be an effective, almost indisputable means of serving justice accurately and effectively.

Radio interface

The future radio design should have a full-colour, night-time adjustable touch-screen interface. It was suggested to make interfacing with the product's screen faster and more efficient, a stylus or similar technology type should be used. This is due to the ineffectiveness and lack of speed when interfacing with contemporary touch-screen products.

Mobile computing

Mobile computing and database connection is very desirable in a future radio design. Access to street and geographical maps could improve the effectiveness and response time of officers dramatically.

The future radio design should also be capable of identifying individuals using a facial recognition system, which like the thumbprint scanning system would be connected to a national and potentially international database.

Individual identification

Officers desire a fast efficient means for identifying an individual; thumbprint scanning and identification via a national database is a highly desirable system for integration into a future radio design.

The use of thumbprint scanning technology to identify the radio user (the officer) has high potential for application and integration into the final design, as well as other non-intrusive forms of biometric identification, for example facial recognition and DNA identification. This is to prevent unauthorised use and access to the police network.

7.6.2 - Concept Analysis Design Criteria

Performance Criteria	Required	Desirable (High)	Desirable (Moderate)	Desirable (Low)
Multiple personal audio wireless options (intrusive, non-intrusive)	<input type="radio"/>			
Body position: Future radio should attach to the chest/upper torso of a utility/protection vest/harness		<input type="radio"/>		
Built-in camera (still and video)		<input type="radio"/>		
Touch-screen interface			<input type="radio"/>	
Stylus interface		<input type="radio"/>		
Access to street and geographic maps			<input type="radio"/>	
Multiple biometric methods of rapidly identifying an individual		<input type="radio"/>		
Reliable product design	<input type="radio"/>			

Table 7.24 - Concept Analysis Design Criteria

Experience Criteria	Required	Desirable (High)	Desirable (Moderate)	Desirable (Low)
Robust styling	<input type="radio"/>			
Comfortable to hold			<input type="radio"/>	
Secure, reliable attachment to body	<input type="radio"/>			
Strong confident product weight			<input type="radio"/>	

Table 7.25 - Concept Analysis Design Criteria

8.0 - Final Design Criteria

Performance Criteria	Required	Desirable (High)	Desirable (Moderate)	Desirable (Low)
Flexible system design that is able to expand and contract in user-system capacity according to demand	<input type="radio"/>			
Ability to function in both types of radio assignment scenarios (group and personal issue, see section 3.3)	<input type="radio"/>			
Multiple audio options to accommodate officer's personal preferences	<input type="radio"/>			
Ability to record, transcribe and retain audible and visual data		<input type="radio"/>		
'Fail-safe' operation (back-up system design)	<input type="radio"/>			
Ability to operate in adverse weather and spatial conditions	<input type="radio"/>			
Reliable product design	<input type="radio"/>			
Autonomous emergency system		<input type="radio"/>		

Table 8.1 - Final Design Criteria

Performance Criteria	Required	Desirable (High)	Desirable (Moderate)	Desirable (Low)
Rapidly replenishable energy source		<input type="radio"/>		
Stylus interface			<input type="radio"/>	
Touch-screen interface			<input type="radio"/>	
Multiple personal audio wireless options (intrusive, non-intrusive)	<input type="radio"/>			
Body position: Future radio should attach to the chest/upper torso of a utility/ protection vest/harness	<input type="radio"/>			
Private, secure and encrypted system design	<input type="radio"/>			
Multiple biometric methods of rapidly identifying an individual		<input type="radio"/>		
Ability to communicate an officer's geographic location to all officers on the system, as well as comms			<input type="radio"/>	
Ability to send and receive photographic files (still and video)		<input type="radio"/>		

Table 8.2 - Final Design Criteria

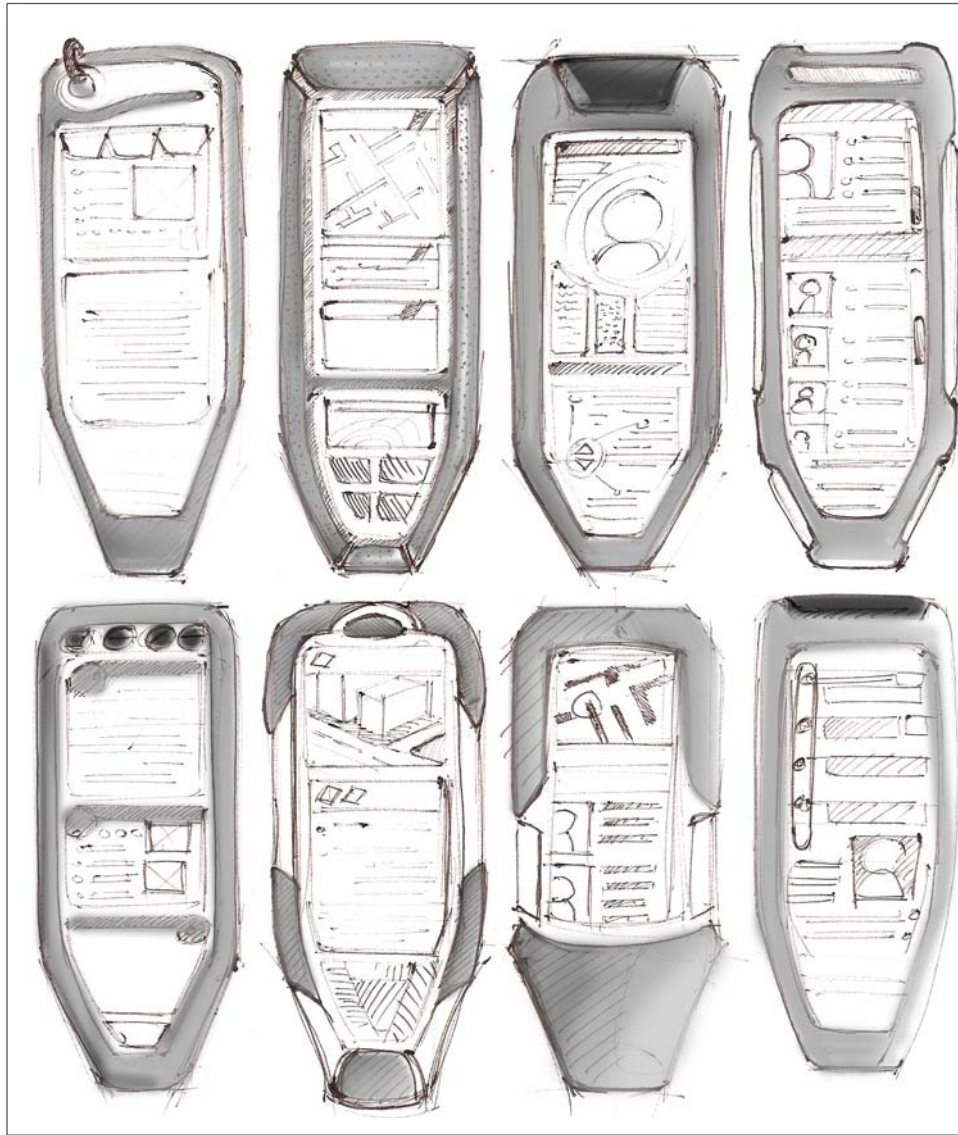
Experience Criteria	Required	Desirable (High)	Desirable (Moderate)	Desirable (Low)
The future radio should				
- Comfortable to hold			<input type="radio"/>	
- look like a professional product		<input type="radio"/>		
- be formal in colouration			<input type="radio"/>	
- evoke ideas of reliability		<input type="radio"/>		
- be visually strong in proportion, composition and overall product design		<input type="radio"/>		
- evoke ideas of durability	<input type="radio"/>			
- have a high level of utility	<input type="radio"/>			
- be a responsible use of resources, through material selection and product construction			<input type="radio"/>	
- have an interface that is easy to use and understand	<input type="radio"/>			
- have a confident product weight			<input type="radio"/>	

Table 8.3 - Final Design Criteria

Experience Criteria	Required	Desirable (High)	Desirable (Moderate)	Desirable (Low)
Robust product styling		<input type="radio"/>		
Secure reliable attachment to the body	<input type="radio"/>			
Identification function(s) should be un-obtrusive			<input type="radio"/>	
Identification function(s) should be easy to operate		<input type="radio"/>		
Replenishment of the radio's energy source should be easy and uncomplicated		<input type="radio"/>		
Emergency function should be activated deliberately, not by accident		<input type="radio"/>		

Table 8.4 - Final Design Criteria

8.1 - Final Design Development



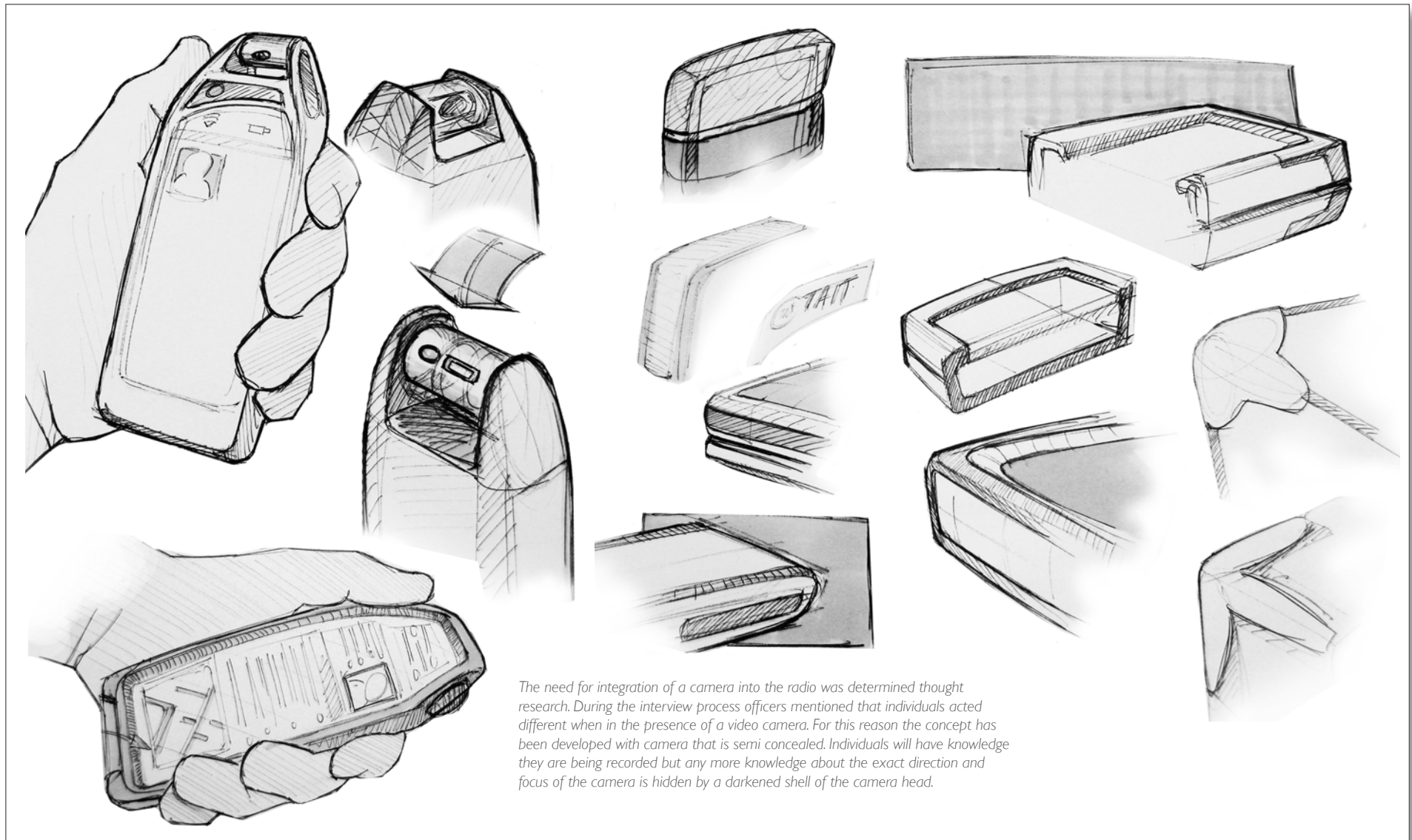
To define the product composition an exploration into different materials and how they are perceived to be tough, robust and reliable was undertaken. Power tools were used as a visual example, however the level of professionalism is questionable.

Although injection moulding is considered tough and reliable and it is a strong part of Tait's current products it is not easily recycled. The world is becoming more environmentally conscious and I believe Tait could lead the way in this product area if they adopted some greener manufacturing technologies.

Exploration into the type of interface was undertaken. The Police need to have a controlled amount of information presented to them at any given time, for legal reasons and for operational reasons. For example: A major part of an officers training is understanding how to act and react to people and their temperament.

To safely and effectively execute their job officers require a device that is simple and easy to use, that does not take great effort or mental power to operate. In some respects the interface functions should be able to be used subconsciously, in a similar fashion to how current officers adjust their audio volume settings without having to look down. This is the main motivation behind the concepts operating structure and presentation.

Figure 8.4 - Final Concept Development



The need for integration of a camera into the radio was determined through research. During the interview process officers mentioned that individuals acted different when in the presence of a video camera. For this reason the concept has been developed with camera that is semi concealed. Individuals will have knowledge they are being recorded but any more knowledge about the exact direction and focus of the camera is hidden by a darkened shell of the camera head.

Figure 8.2 - Final Concept Development

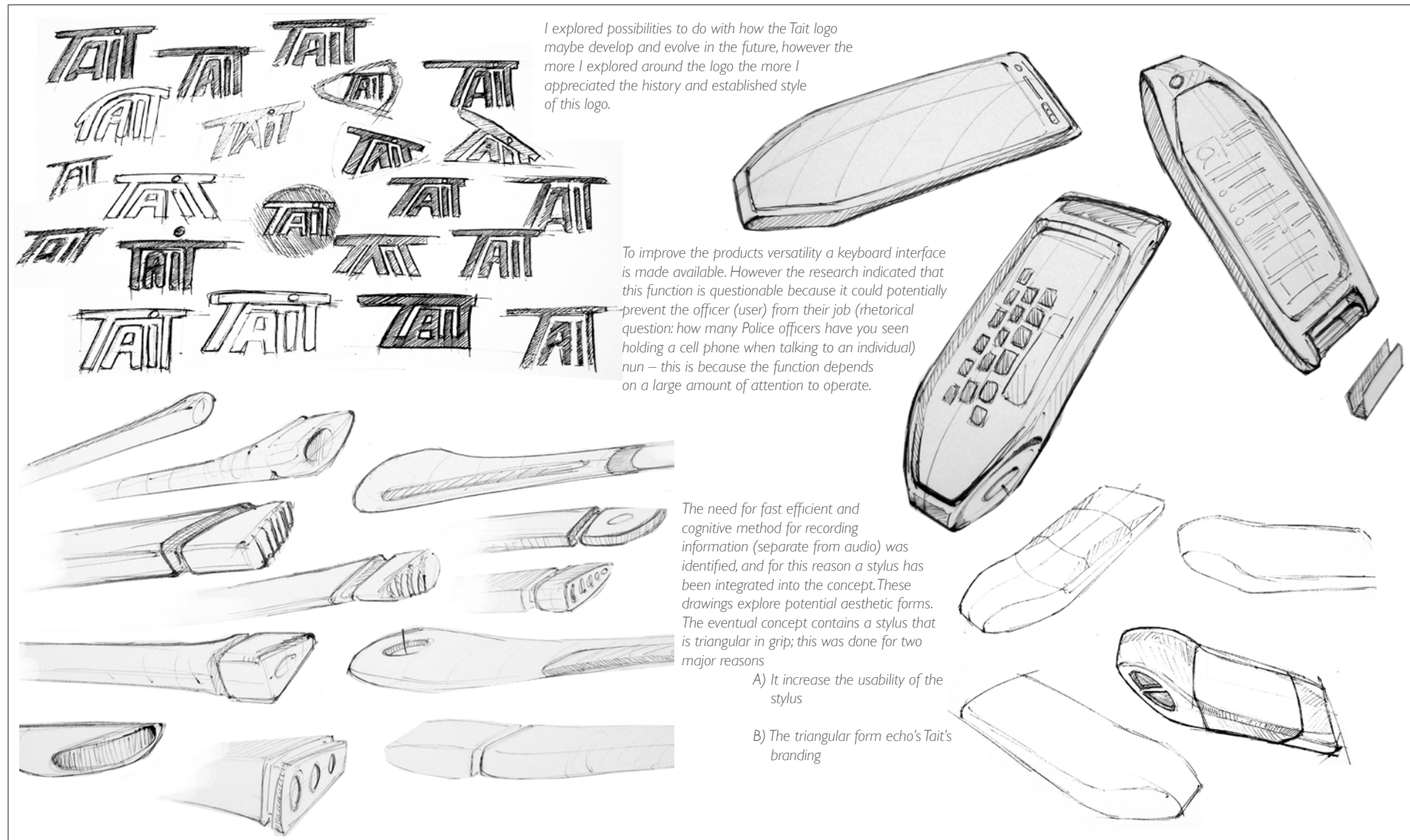
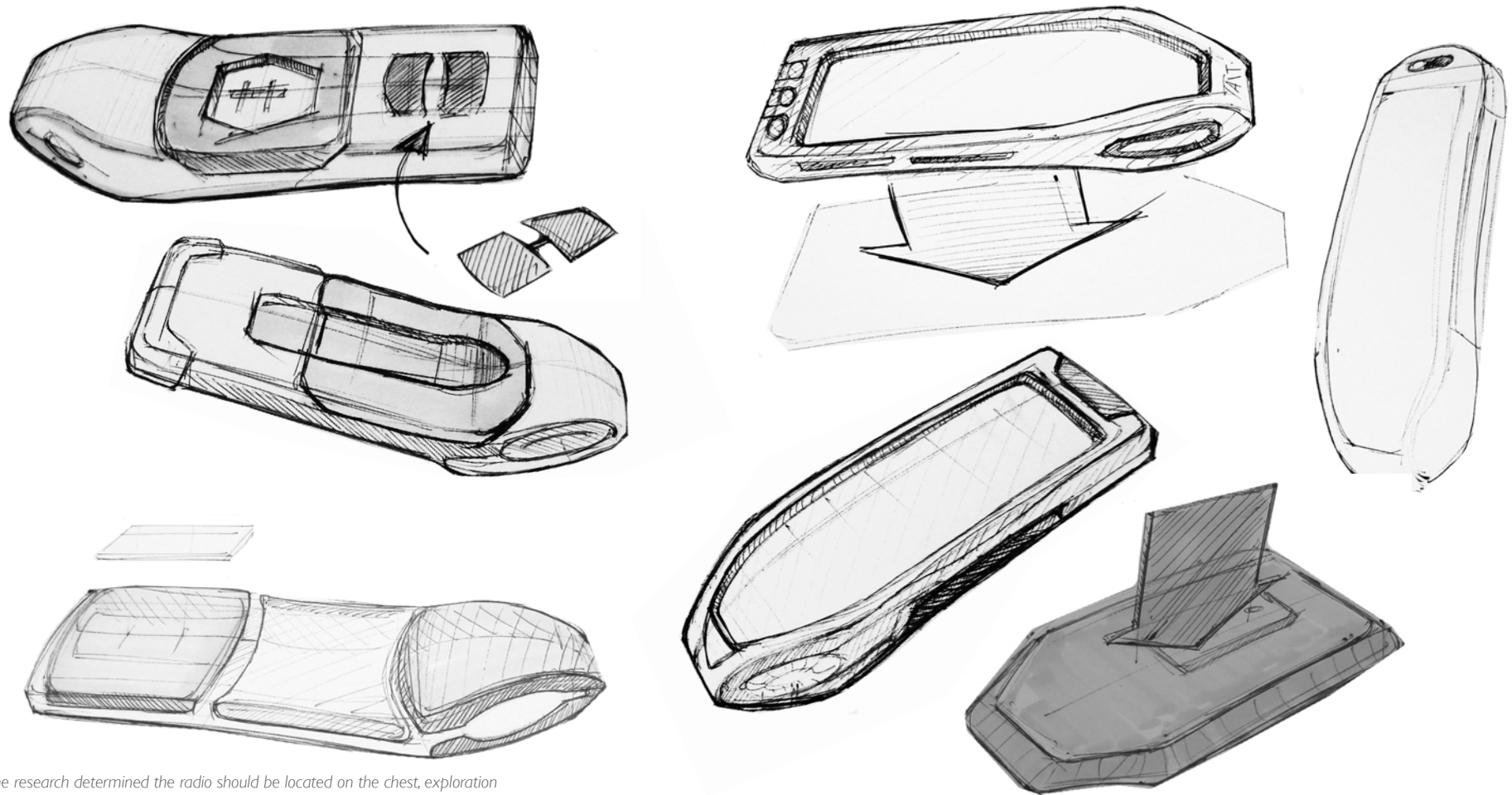


Figure 8.3 - Final Concept Development



The research determined the radio should be located on the chest, exploration into different methods of attachment to the user were investigated. It was determined the most efficient and effect attachment process would be to have the mechanism integrated as part of the main radio so to simply fly the amount of integration needed with future officers apparel (protection and carrying vests).

Figure 8.5 - Final Concept Development

Final Design

8.3 - Final Concept Design



Figure 8.6 - Final Concept Floating



Figure 8.7 - Final Concept Audio Options



Figure 8.8 - Final Concept Vest Attachment

8.4 - Main Radio Unit Design

The main radio is designed to look aesthetically professional, robust, authoritarian, highly usable and dynamic. This is done through the following form details:



Figure 8.9 - Final Concept Unit Design

A) - The radio has minimal part lines to increase the perception of reliability and robustness.

B) - A high protective ledge surrounds the main display-screen; this acts as a visual signifier as to the product's robust and authoritarian quantities.

C) - The underside of the radio has a rubberised grip that is coloured to be slightly grey in appearance. This grip is positioned to increase the usability and 'gripability' of the radio.

D) - The control buttons that are located at the bottom of the radio are recessed into the main form, to prevent accidental activation.

E) - The radio is designed to be sympathetic to a large range of hand sizes.

F) - The materiality selection for the main radio is chosen to provide a robust, strong, mark-proof casing for the radio.

G) - Professionalism is obtained through the radio by the use of formal colours. The inner screen surround is a light shade of black. The main outer casing is matte black and the radio's outer-rubberised grip is a moderate tone of grey/black mid-tone.

8.5 - Audio Options

Through research it was established that private audio is a requirement for police communications. To audibly interact with their radio officers are given the choice between two earpiece options:

Option A)

Audio option A is a standard earpiece design, which includes noise-cancelling technology to improve audio clarity. This earpiece is intrusive to the user because of its ear-bud design.

Option B)

Audio option B is designed to be non-intrusive to the radio user. The concept behind this earpiece is that the user's audio sensors are not compromised. Instead of a physical 'bud' being used the audio is projected into the user's ear.

Earpieces are wirelessly powered from a power emitter encapsulated in the main radio unit. The earpieces are designed to be as small and lightweight as possible.

Earpieces are electronically tethered to the main radio unit. If the audio unit is separated from the unit by a distance of more than 10 meters the audio earpiece deactivates. The officer can then use their radio to locate the earpiece in a similar fashion to how a metal detector would when searching for metal. This increases perceived reliability of the earpiece and minimizes the risk of losing it.



Figure 8.10 - Final Concept Audio Options

If the radio user loses or misplaces the earpiece a new earpiece can be assigned to the radio and the user; this is a simple task of placing the desired earpiece on the radio's display screen and saying the voice command "recognise new earpiece." The radio would then ask the officer to identify him or herself. For this procedure the officer would identify himself or herself through a vocal identification process.

8.6 - Body Position

The main radio unit attaches to the officer's utility/protection vest. Through research this was determined to be a highly likely development in respect to police apparel and equipment design for the year 2018. This design feature requires a partnership between the radio's manufacturer (Tait) and the apparel company that designs and manufactures the vest or a universal attachment standard.

The radio attaches securely to a rubberised pad that is integrated into the design of the vest; this pad does not hold any type of energy charge or operation ability.

The location of the radio is designed to give user maximum accessibility to the radio. The orientation of the radio is designed to evoke ideas of strength and confidence; this is achieved through the radio's form and dynamic lines. When the radio is located on the vest and is not being used for any other options except for audio communication the display screen also acts as a proxy police badge, displaying the officer's ID number.



Figure 8.11 - Final Concept Vest Attachment

Incorporated into the main radio unit design are small electromagnets. These magnets securely hold the radio in place when it is located on the vest. A locating slot situated on the back of the radio aids in guiding the radio to the rubberised pads on the vest. To remove the radio from the vest the user has two options.

Option 1)

Through the use of a voice command “detach radio”. The radio is programmed to only respond to the officer’s voice that it is designated to.

Option 2)

The second method required the user to press both of the control buttons situated at the bottom of the radio. When the officer presses the control buttons the radio automatically identifies the user (via a thumb and fingerprint scan). This ensures the radio is not used by anyone but the officer it is assigned to. Using two buttons reduces the risk of accidental detachment.



Figure 8.12 - Final Concept Radio Dettachment

8.7 - Interface Design

The primary method for interacting with the radio device is audio control functions; this method is dependent on the 'control phrases'. The user would say a pre-determined phrase to execute a task. This method of interacting can take longer to execute than conventional methods. For example, to manually increase the audio volume the officer has two options. The first is to say "adjust volume manually." The officer would then specify how much louder or quieter they desire the device's audio to be. The second method would involve the use of the control buttons situated at the bottom of the radio unit.

Depending on the type of interaction the officer has one of three options beyond the audio interface as to how they interact with their radio:

Stylus

To quickly and efficiently record information the radio is equipped with a built-in stylus. This stylus can be removed from the device by pushing the cover cap with sufficient pressure and in the right direction. Like the audio earpiece options the stylus is electronically tethered to the radio.

The stylus is a standardised design so replacing it is a simple process. The stylus is shaped in a triangular format. This is done to increase gripability of the stylus and is also a subtle hint towards the Tait brand (established in section 5.2.3 some of Tait's products use a rounded triangular form as a method of installing dynamism and differentiation into their products).



Figure 8.13 - Final Concept Stylus

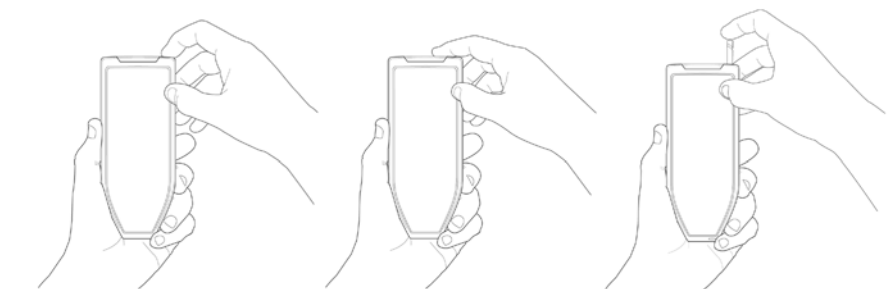


Figure 8.14 - Stylus Removal

Touch-screen

To interface with the radio the officer can use the touch-screen. Established through research was the need for an interface system that can be operated even when the officer has their standard issue protective gloves on. To make this possible the radio's touch-screen interface has been designed with a built in fluid-cell substrate. The actual surface does not raise in profile; it does however depress. When an individual presses on the touch-screen they are rewarded with a tactile sensation. The surface of the touch-screen depresses momentarily and then regains its original standing form once the user's finger(s) are removed. The fluid-cell substrate becomes ridged when using the stylus interface. This fluid-cell substrate also acts like a protective cover for the display screen.

Depending on the menu function selected the display-screen presents a full alphabetic keyboard and/or alphanumeric keyboard if required. Because of the limitations of the display-screen size the letters (or numbers) magnify in size when pressed. This method can be slow but ultimately is required because it is a standard method of interacting with a portable device.

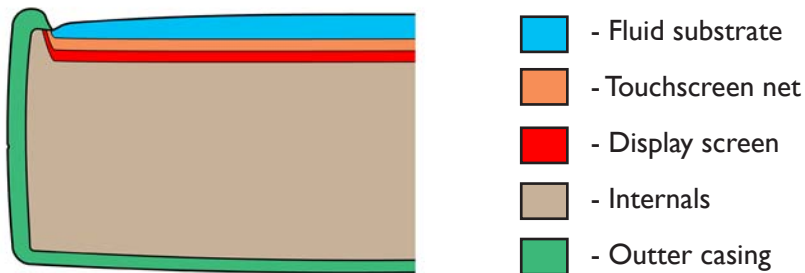


Figure 8.15 - Fluid-Cell Substrate



Figure 8.16 - Touchscreen

Control buttons

Located at the bottom of the radio are two buttons. The primary function of these buttons is to give the user a tactile method of releasing the radio from the rubberised pad located on the officer's vest. The secondary function of the control buttons is to give additional usability to the radio's interface. For example, the officer could pre-assign a function to each of the control buttons i.e. the right control button could activate the radio's image capture function. The radio's control buttons are recessed and do not protrude from the radio's body. This is to prevent accidental operation.

Camera observer

The radio's camera function is constantly recording all of the interactions of the officer throughout their shift. Not only does this camera visually record the interactions of the officer, it also records the audio interactions and location of the officer during their shift. The primary driver behind this feature is not to monitor the effectiveness or efficiency of an officer (although it can be perceived the radio may be used in this manner), it is instead to serve as an additional method of gaining irrefutable data that can be used to aid in prosecution of an individual.

The officer does not have control of this camera function; it is instead independent. The camera's visual framing is consistently searching for objects and people to identify, similar to how current cameras search for a face to focus on. The camera is encapsulated at the top end of the radio for three reasons.



Figure 8.17 - Final Concept

Blacked out shell

The camera is not visually pronounced, this is because if an individual has knowledge they are being viewed or filmed their behaviour can change. The cover shell also acts as a protective feature, protecting the internal workings of the camera while also reinforcing the aesthetic robustness and strength of the product.

8.8 - Energy Source

Through trend mapping it was determined that in the future (2018) radio technology will have greatly improved performance abilities. For this reason the radio's energy source is incorporated into the product's body. The need for multiple batteries has been eliminated. The battery life of the radio has a maximum full operation time of 24 hours; this time estimate was generated through analysis of current technology energy use and how their efficiency will increase if trends continue.

Charging the radio is effortless for the user. Radios are remotely charged through a wireless energy transfer system. These energy transfer stations are situated in all police stations and police vehicles. Because the radio technology has evolved to the stage where the energy source does not have memory the energy source is constantly topped up. The radio is also constantly receiving an energy charge through transfer of kinetic energy (officer movement).

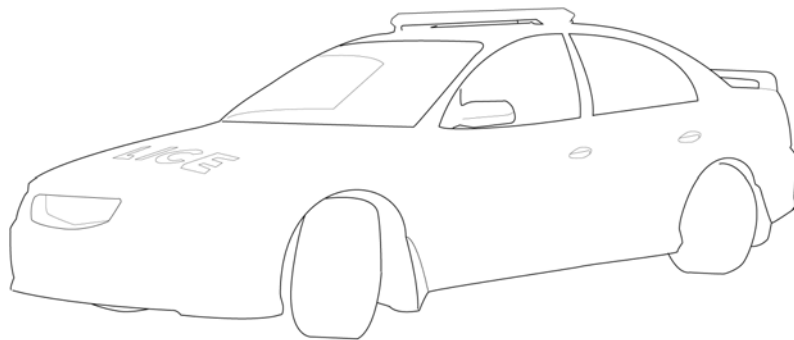


Figure 8.18 - Police Vehicle

8.9 - User Identification

User Identification

To use the radio an officer needs to create a profile in the radio system. This involves the officer's biometric information being loaded into the system (audio, visual, thumb and finger print), once this information has been verified the officer then selects a five digit password. The officer is now free to use any Police radio he/or she desires because of the system design of the radio.

Non-officer Radio Use

Using the same technology as the thumbprints scan, the user is identified every time they use the touch screen. The identification process is instantaneous. If a non-identified (non-police) user attempts to use or interface with the radio then the radio stops operation and creates a direct audio and visual link (only for the comms operator) with the radio. The purpose of this function is to protect the information and network security of Police comms and database.

8.10 - Interface Design

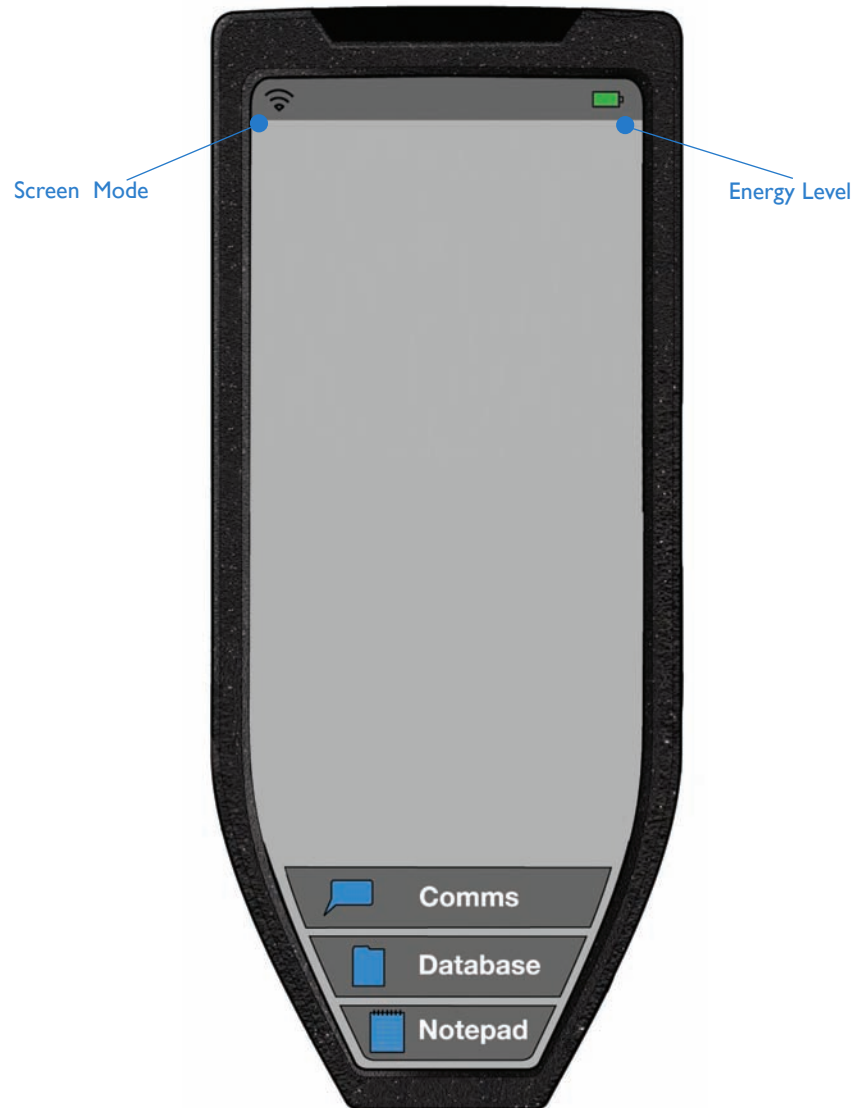


Figure 8.19 - Interface Design

Interface Screen Layout

The interface screen layout is designed for high usability and simplicity. The menu buttons are over sized to give the user a large straightforward set of menu options. The display screen has two icons that are constant.



- At the top right of the screen is the radios energy charge icon (represented by a classic battery shape). Although the design of the energy system means the radio will be unlikely to loose it's charge, the researcher determined that a visual representation of the energy charge was needed to increase users perception of confidence and reliability in the radio.



- Located at the top left of the Screen is the display screen modes Icon. This icon represents the display screen mode, the three different screen modes are detailed later in this section.

Icons have been designed to be as simple and straightforward as possible. Colour is only used to differentiate menus and functions. This is because too many colours used in the interface decreases the usability and visual simplicity of the product.

8.11 - Pre-set Operation Modes

In some situations it is desirable for the radio to be able to operate in a pre-determined fashion. Through the use of a voice command the officer can activate one of three pre-set operation modes.



Standard Screen Mode

This is the screen mode that is the standard operating mode. This is the operating mode that officer would use the majority of the time.



Covert mode

The radio's settings are streamlined for stealth operation. This pre-set mode is appropriate for use in situations when covert operations are required. For example, an officer would be observing an individual and does not want to give away their presence. For this mode of operation the following adjustments are effected:

- Display screen changes to a night vision blue
- Decreased audio volume
- Reduced display screen lighting



Alert Mode

This mode would be activated by the officer prior to attending a situation that has potential for immediate action by the officer, e.g: The officer is attending to a live event that is in progress. The audio communication functions are given precedence over all others and a direct line to a comms operator is established.



Figure 8.20 - Covert Screen mode



Figure 8.21 - Alert Screen Mode

The radio's other functions are streamlined to give the officer access to immediate information that they may require. This includes the officer's location and the communications history presented in a visual format. Very similar to the Live event screen but not with information about an individual.

Comms communication

To increase officer security the communication system has been designed to be able to expand and contract its operational capabilities according to the number of officers. To ensure safe operations one comms operator would be assigned to every twelve to fifteen officers on duty during a shift. It is the comms operator's responsibility to delegate duties and events to the appropriate officers (the closest officer(s) to an event should be the first choice to be assigned to an event). The comms operator has access to a visual map that displays the following information:

- Officer location
- Officer Assignments (shift duties)

The user is in constant contact with the police comms for the duration of their shift. Audio communications are point-to-multi-point at all times unless otherwise specified by the comms user.

Intelligent interface

To increase the usability and efficiency of use a number of the radio's functions are autonomously executed. The radio's audio and display lighting settings adjust according to environmental conditions. For example, if the officer is working a Saturday night in a built-up metropolitan area where there are a lot of people and traffic, the audio settings would automatically adjust to the most appropriate volume level for the officer to comfortably use their radio. In a similar fashion the lighting for the radio's display screen would adjust its settings for optimal operation in the spatial conditions, i.e. brighter in darker spaces.

Live Event

When the comms officer assigns an officer(s) to a new event a new display screen automatically appears. On this display screen the following information appears:

- The map address and directions to the event location
- Suspect information
- Summarised description of the event
- A visual log of the communications to date

Depending on the situation the event is given a priority rating by comms.

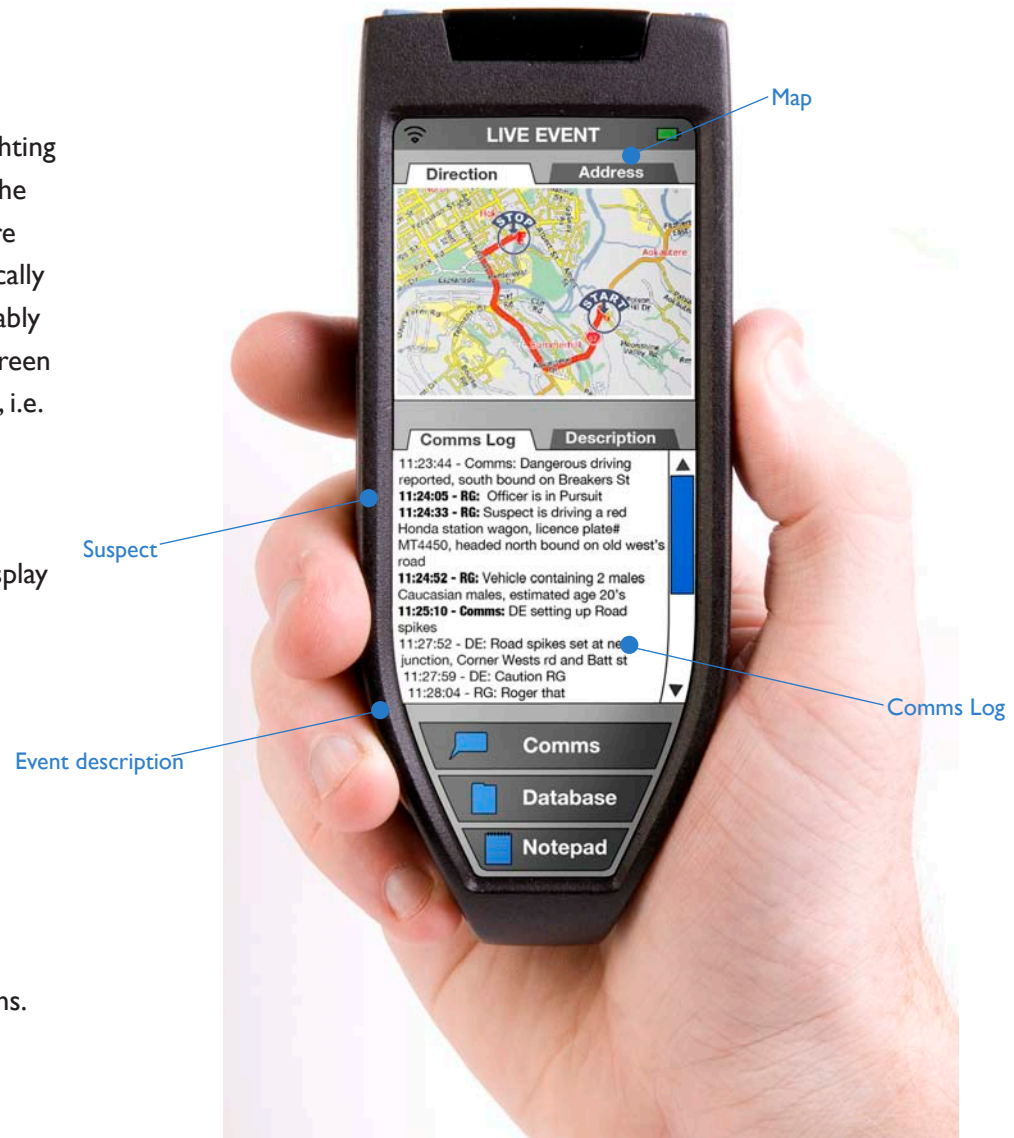


Figure 8.22 - Live Event Display

8.12 - Operating System Design

The operating system design has been divided into three sub-sections:

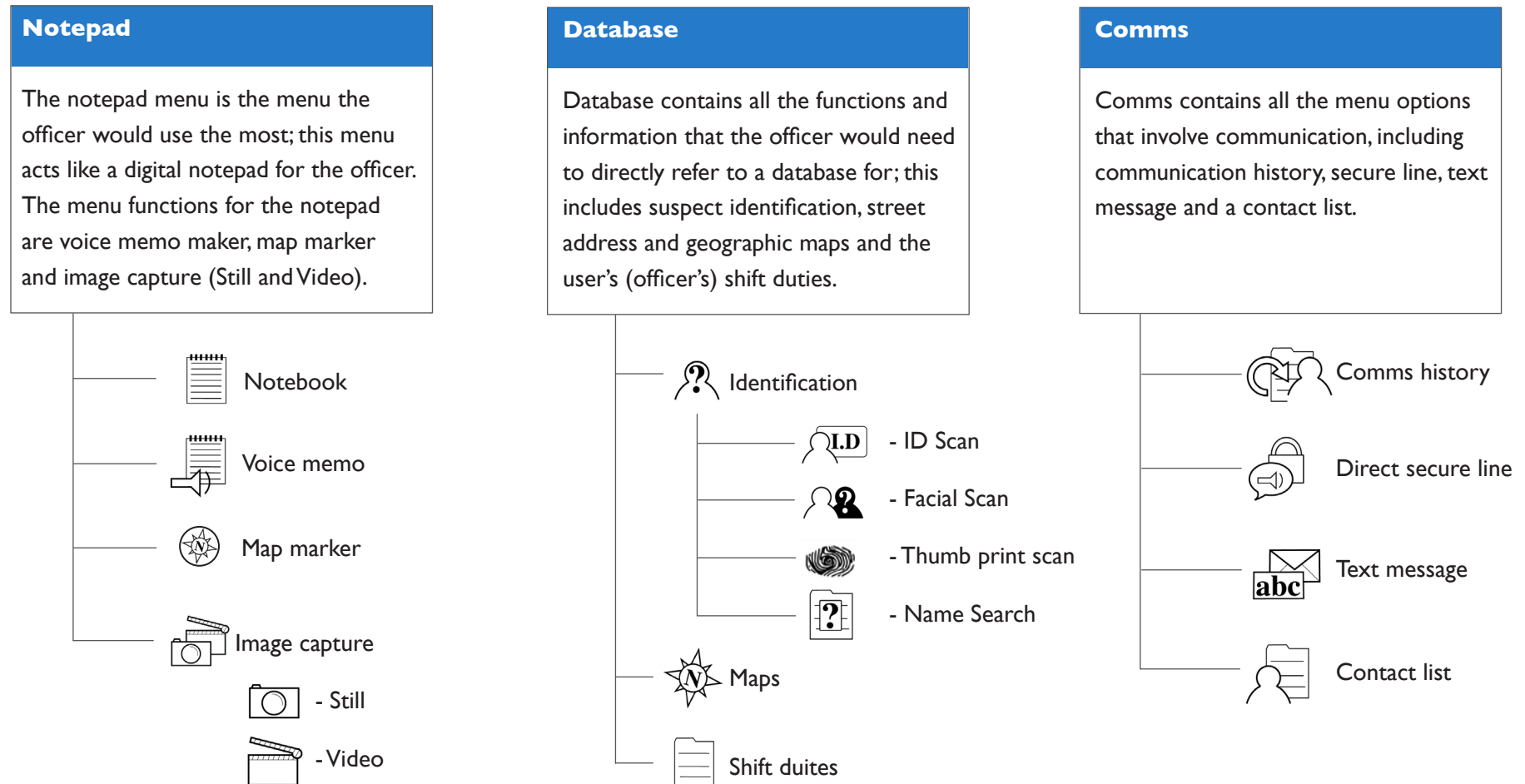


Figure 8.23 - Operating System Design

8.13 - Notepad

Current File

This is a list of current or recent files. The initial file is presented in alphabetical order. To make the file locating process easier the officer can select one of four categories to search the database by:

- Name, the names of the individuals involved
- Date, the date and time
- Location, a search for a street address or location
- Type of crime, files are categorised into the type of crime

Create Event

To create a new event file the officer would select this application. The first step in the process for creating a new event is identifying the individual(s) who are associated with the event. This is done via the four methods demonstrated in the database menu.

Notebook

The purpose of the notepad function is to provide the officer with the means of recording general information or notes that could be used later. This function is best paired with the stylus.



Figure 8.24 - Notebook option



Figure 8.25 - Map Marker Option

Voice Memo

Established through research was the need for a fast and efficient method of recording information about an event or incident. Once this mode is selected the officer can audibly dictate a log entry or 'memo' about the event they have or are currently attending. This memo is instantly transcribed into a manuscript that is automatically transferred to the officer's file logs. The officer can access this either at the police station or remotely using their radio. The officer can link additional visual and file data to these event files at any stage.

Map Marker

Once selected the officer is able to create a map marker and attach it to either their current location or to a selected street address; this map marker is then created in a visual file that is accessible by other officers. The content of these markers is up to the individual officer. Some potential applications of map markers are:

- Identify a good location for monitoring traffic flow
- Identify a well-known criminal activity location
- Personal observation, an officer would write a note about a residence or location. This information could prove to be helpful to other officers.

The purpose of these map markers is to create more intercommunication between officers; the by-product of this increased intercommunication is a deeper sense of community among officers.

Image capture

Using the built-in digital camera the officer is able to collect visual data (both still and video) about an event, individual or location. Although the radio's camera observer function is continuously recording the officer's interactions the purpose of this function is to create a time index marker in the video system. This information is then attached to the appropriate file. The officer is encouraged to use this function of the radio whenever appropriate.

Ascertained through research was officers' desire for a method of recording information that can be used as irrefutable evidence when prosecuting an individual.

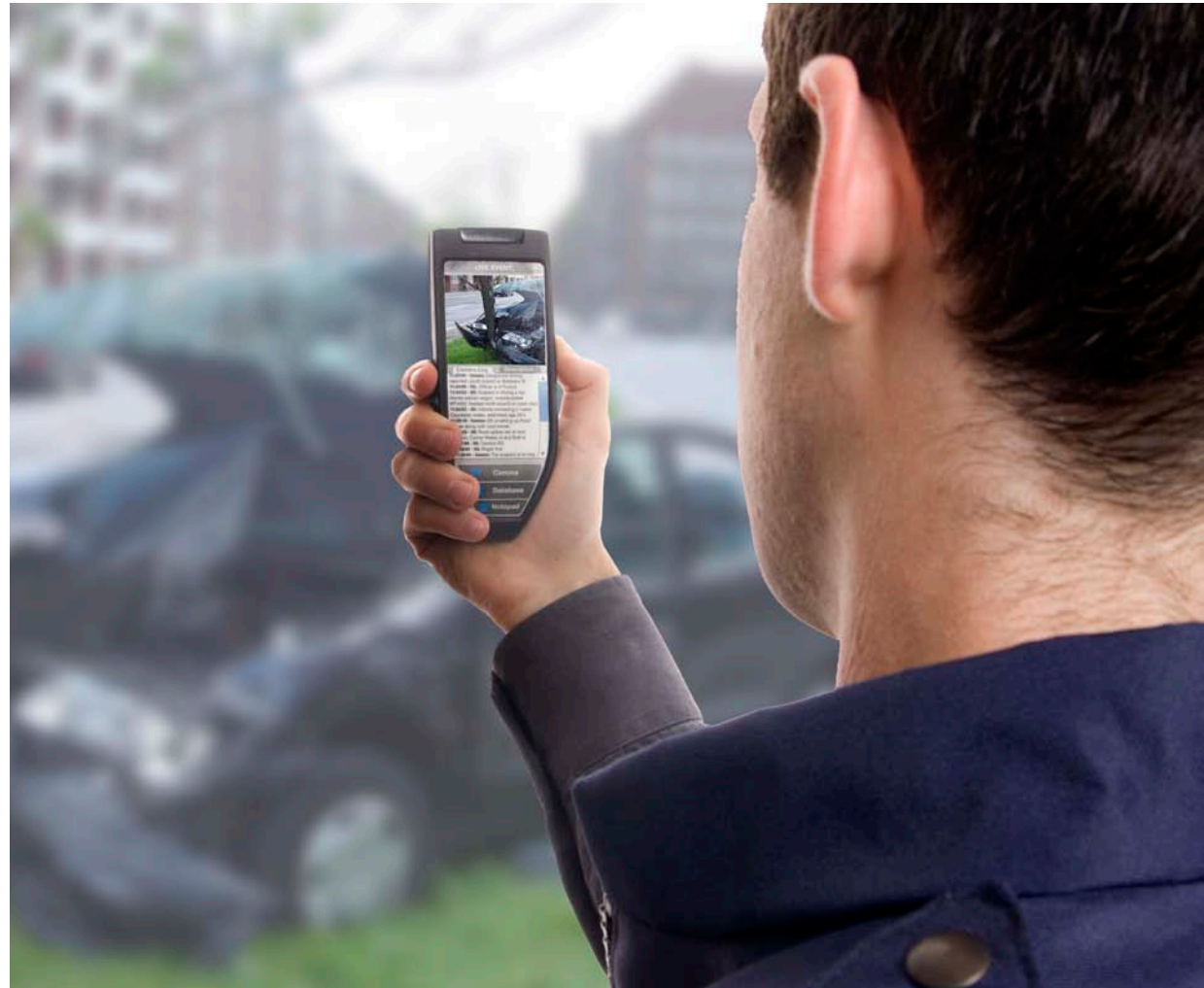


Figure 8.26 - Image Capture

8.14 - Database

Identification

To identify an individual the officer has four options, three of which are reliant on biometric information stored in a national police database. The reason for multiple methods of identification is because in some situations an individual may not fully cooperate. The officer can use his or her own judgement as to which identification method is most appropriate to use for any given situation.

I) – ID Scan

The primary identification method is an ID scan: to do this the officer needs to only briefly hold the individual's ID (drivers licence or passport) in front of the camera end of the radio. This identification method should be the officer's first choice because it is non-threatening to the individual in question and is non-intrusive.

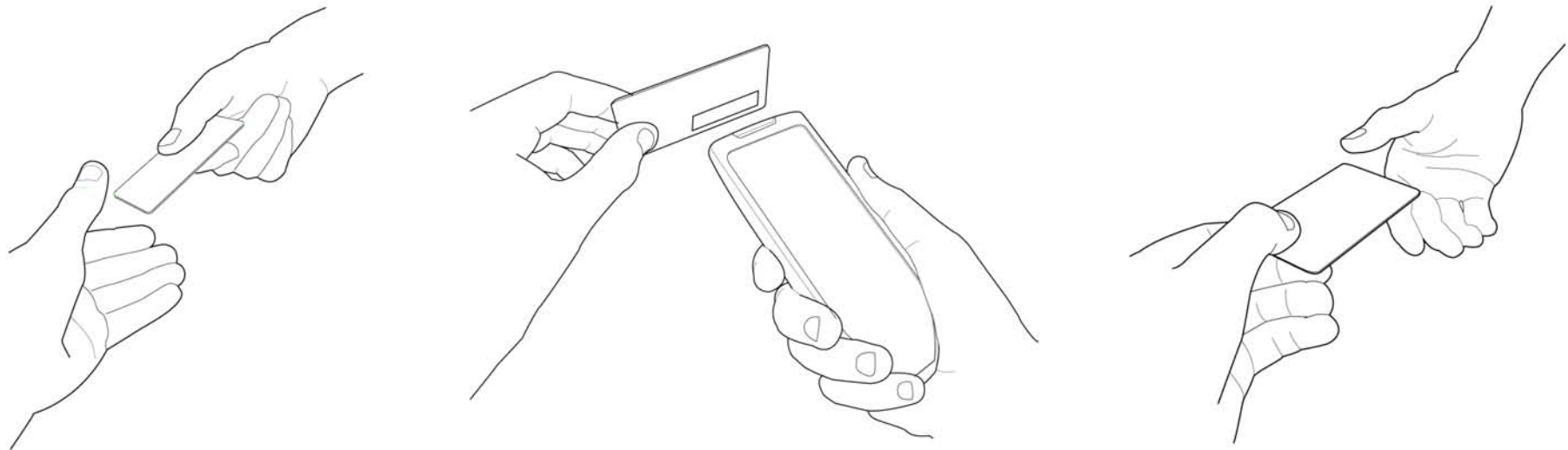


Figure 8.27 - ID Scan Process

2) – Facial Recognition

The second method of identification is a facial scan. To do this the officer holds the camera up to the face of the suspect, the officer should not intrude into the individual's personal space. The process is very similar to taking a photo with a disposable camera or a cell phone. The identification process is instantaneous and non-intrusive, however this method requires the cooperation of the individual to look in the right direction (which in some situations can be challenging).

3) – Thumb Scan

Thumbprint scanning is the most intrusive method of identification; this method should only be used when the primary and secondary methods are either inconclusive or the individual does not cooperate (does not provide a suitable means of identification i.e. a drivers licence or passport, or avoids looking directly at the camera). This identification method requires the officer to physically guide the individual's thumb onto the interface screen (unless the individual voluntarily does this). This method is more favourable for individuals who are handcuffed or restrained in some way.

4) – Name Search

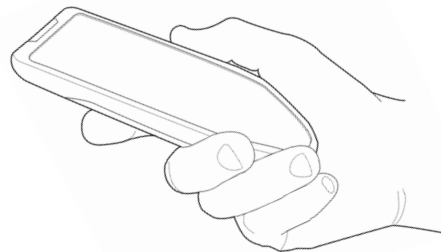


Figure 8.28 - Three-point view of concept

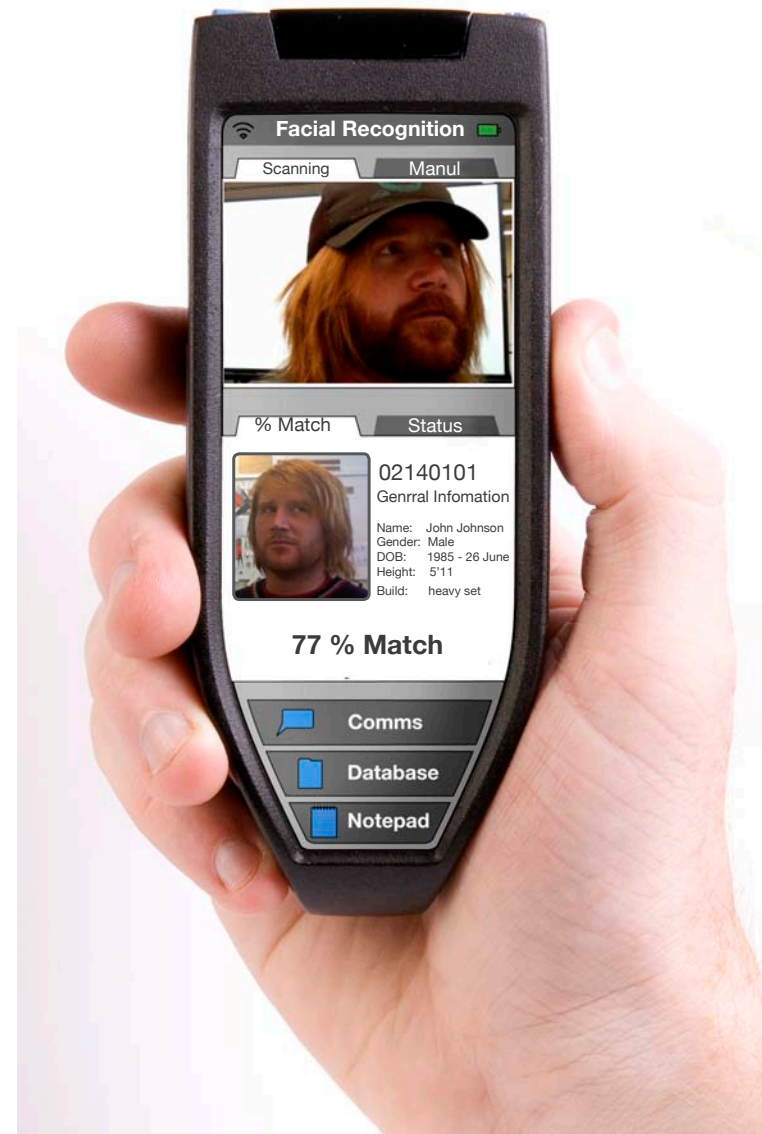


Figure 8.29 - Facial Recognition

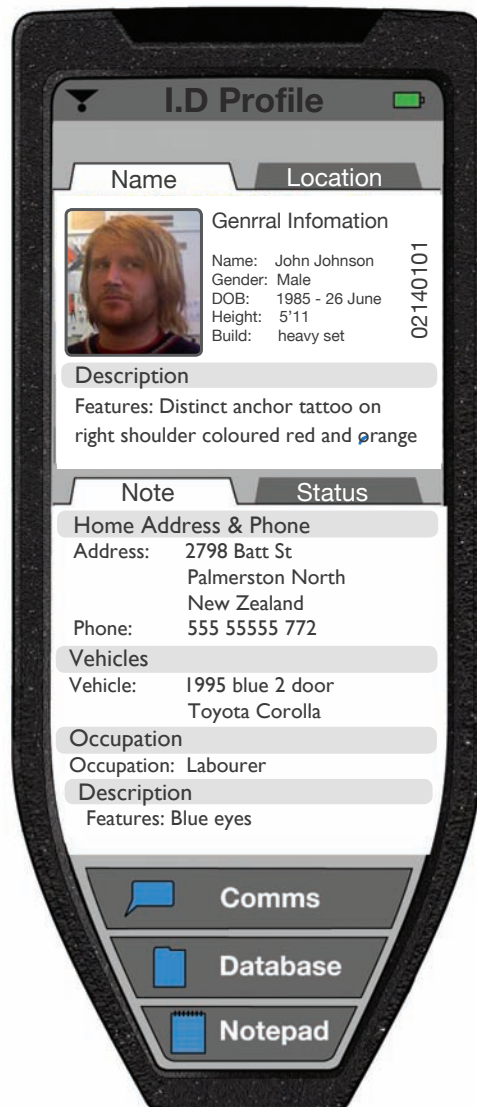


Figure 8.30 - ID Profile Screen

The fourth method of identification is a name/address and description search. This is an aspect of the concept's 'fail-safe' system design. Once the individual's details have been input into the radio an instantaneous search of the database is undertaken. An individual can be searched according to their name, current or previous address of residence and a visual description given by the officer to comms.

Once the individual has been identified by the system the officer is presented with one of two screens:

Screen A)

The first screen is the individual in question's profile. This profile contains all relevant information needed by the officer on the spot, including full name, address, occupation, list of previous altercations a visual description of the individual and any notes attached to their file.

Screen B)

The second screen is a 'flag screen'; this comes up when the individual that has been identified has an active police file. If there is a warrant for the individual's arrest the officer is notified appropriately, through audio notification (which is private and individual to the attending officer) and this visual aid through the flag screen's indication.

The key design feature with this flag screen is that the individual does not get alerted to the content of their file. For example, if the individual that is being identified gets knowledge that there is a warrant for arrest under their name there is a possibility the individual may attempt to escape. This aspect of the radio's interface is designed to be subtle and non-provoking when observed from a distance. Any individual that is identified as having a flag screen is given a rating by the database; this rating is on a scale of five-to-one, one being a minimum level of risk and urgency and five being the maximum level and that extreme caution.

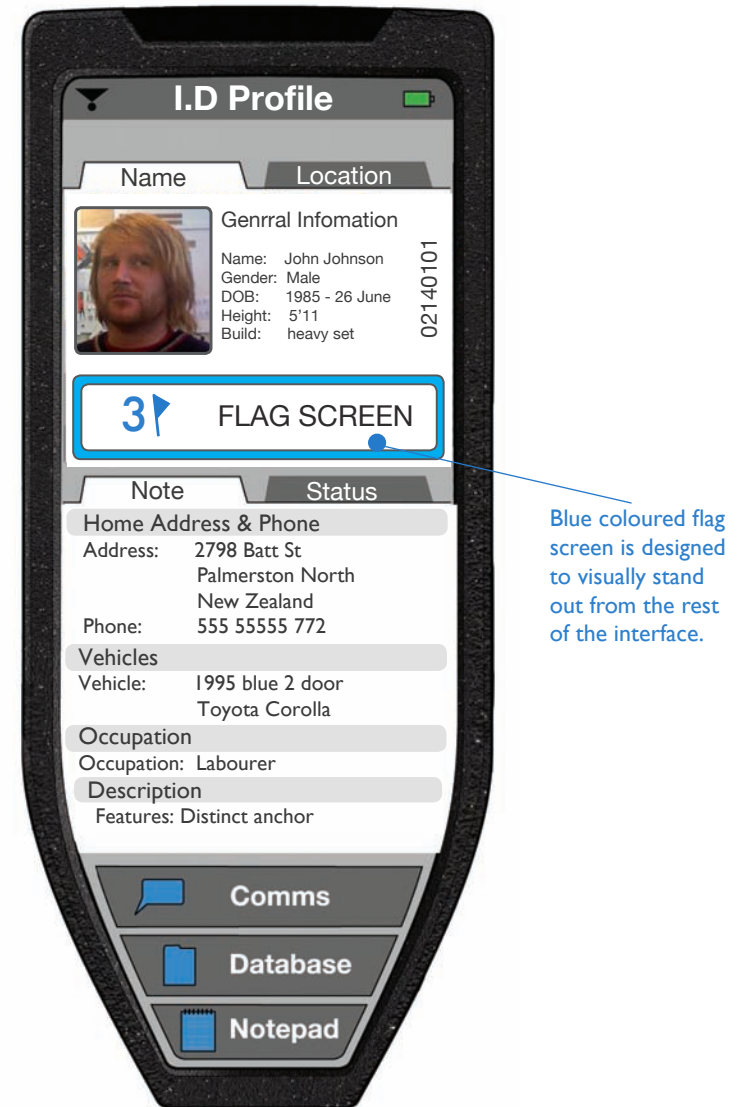


Figure 8.31- ID Profile Flag Screen

8.15 - Communications

Text Message

If required the officer can send and receive text messages to any other individual on the police system. To do this the officer would use the alphabetical keyboard interface function.

Secure Line

To initiate a private conversation the officer would select the communications menu (either through voice command, or using the touch-screen interface) and would specify whom they want to talk to (through a contact search, or by manually dialling in a phone number). This type of communication would mostly be used when an officer needs to talk to an individual that is not a part of the police network, for example, when an officer requires a statement from an individual he or she phones the individual directly and privately.

Find Contact

This menu selection provides the officer with access to the national telephone directory. The officer can then choose their method of communication (text message or a secure line).

Communication History

This menu selection provides the officer with a visual means of viewing their own and comms communication history. This function would be useful when constructing an event's chronology. To increase the legibility and to make the comms history easier to read each officer is assigned a colour for their text to be presented.



Figure 8.32 - Alphabetical Keyboard



Figure 8.33 - map index

Maps

The map menu selection provides officers access to a series of street address and geographic maps. They can apply a wide range of map overlays to find the desired information. This is a list of the map overlays the officer can choose from:

- Unit Location, both the officer's location and the location of other police officers
- Directions to an address or location
- Criminal information about an address or location
- Access to map markers created by other officers
- An event history map, for example what locations or addresses have been the victim of a burglary.

Each map overlay can be viewed according to a time index, for example the officer could request a visual map of arson crimes committed in an area in the last 3 months.

Shift Duties

At the beginning of a shift during 'fall-in' officers are allocated their shift duties. This menu selection identifies what the officer is required to do during their shift and any special duties they are required to undertake. For example during an evening shift a potential shift allocation could be to go 'door knocking'. This requires the officer to visit a series of address to check if parole are meeting their court appointed bail requirements, such as a curfew. As an example as to how police duties could be streamlined through the use of this radio, as the officer would only be required to visit the residence, knock on the door and the facial recognition system paired with the appropriate shift duties selection would do the rest.

8.16 - Autonomous Emergency Functions

Emergency Function

Once the emergency function has been triggered the officer is put in direct contact with their comms operator. It is then the comms operator's task to delegate officers to assist the officer who activated their emergency function. The comms operator uses the built-in camera function of the radio to observe the situation and make judgment calls accordingly. The emergency function can be triggered through one of three methods:

Emergency Manual Operation

For the officer to manually activate it, the officer simply presses hard against the radio's display surface with their full palm for a period of 2 seconds or more. Having to press the display for an abnormal period of time eliminates the accidental operation of the emergency function.












Weapon Detector













This autonomous function only activates when the radio identifies the presence of a weapon (Using the radios built-in camera and a system up-link to interoperate forms and objects). If the officer is holding their radio when a weapon is detected a subtle audio and display function alert the officer to the presence of the weapon. Otherwise the radio is located in its standby position on the officer's vest an audio alert is given to the officer and to the Comms operator. The purpose of this function is to increase the officer's safety.














Biohazard Detector










Similar in function to the weapon detector the biohazard detector alerts the officer if there are any potentially toxic or dangerous substances in the officer's immediate atmosphere. This function is designed to increase the safety of the officer(s) while working. An example scenario for when this function would be activated is when an officer enters a residence that has been illegally creating methamphetamines (P). The chemicals used to create P pose an immediate danger to the officer's health.

9.0 - Final Design Analysis

Performance Criteria	Required	Desirable (High)	Desirable (Moderate)	Desirable (Low)	Key:  Criteria Fulfilled  Criteria Not Fulfilled
Flexible system design that is able to expand and contract in user-system capacity according to demand					
Ability to function in both types of radio assignment scenarios (group and personal issue, see section 3.3)					
Multiple audio options to accommodate officer's personal preferences					
Ability to record, transcribe and retain audible and visual data					
'Fail-safe' operation (back-up system design)					
Ability to operate in adverse weather and spatial conditions					
Reliable product design					
Autonomous emergency system					

Performance Criteria	Required	Desirable (High)	Desirable (Moderate)	Desirable (Low)	Key:  Criteria Fulfilled  Criteria Not Fulfilled
Rapidly replenishable energy source					
Stylus interface					
Touch-screen interface					
Multiple personal audio wireless options (intrusive, non-intrusive)					
Body position: Future radio should attach to the chest/upper torso of a utility/ protection vest/harness					
Private, secure and encrypted system design					
Multiple biometric methods of rapidly identifying an individual					
Ability to communicate an officer's geographic location to all officers on the system, as well as comms					
Ability to send and receive photographic files (still and video)					

Experience Criteria	Required	Desirable (High)	Desirable (Moderate)	Desirable (Low)	Key:  Criteria Fulfilled  Criteria Not Fulfilled
The future radio should					
- Comfortable to hold					
- look like a professional product					
- be formal in colouration					
- evoke ideas of reliability					
- be visually strong in proportion, composition and overall product design					
- evoke ideas of durability					
- have a high level of utility					
- be a responsible use of resources, through material selection and product construction					
- have an interface that is easy to use and understand					
- have a confident product weight					

Experience Criteria	Required	Desirable (High)	Desirable (Moderate)	Desirable (Low)	Key:  Criteria Fulfilled  Criteria Not Fulfilled
Robust product styling					
Secure reliable attachment to the body					
Identification function(s) should be un-obtrusive					
Identification function(s) should be easy to operate					
Replenishment of the radio's energy source should be easy and uncomplicated					
Emergency function should be activated deliberately, not by accident					

9.1- Discussion and conclusion

This section as been categorised into two headings,

Process – A reflection of the research and design processes used for this project.

Final Design – An examination of the design outcome of this investigation.

Process

As a designer I felt this project contained some unique challenges in respect to the research methods used. Part of the process required four individual concepts to be created; each concept was given direction through the forecasting method.

To present the concepts short films were created. In retrospect these films are dry and would benefit from some more emotive direction. For example, when presenting the 'Safety' concept (see Appendix 01) an increased emotional understanding of the product could achieve through use of paramilitary uniform by the user, or potentially the use of a damaged concrete wall as a background.

A large research component of this project was the use of Warell's PPE (Warell, 2008), which was very effective when used as a analysis tool, however as a tool I believe it lacks direction in relation to how a product is experienced during use and how that experience changes over time.

Final Design

As a product concept I believe this has a high potential for use in ten years time, it takes into consideration the users desire for a product that is reliable, robust and appropriate for use. A mandate for a forecasting project is to create a product that has 'blue-sky' elements to its design; traditionally (as observed through forecasted concepts in other product areas) these concepts are highly theoretical, slightly abstract and in some examples impractical. Through this project it was defined that the police of future desire a reliable product, this was the most important over all other product values. This product requirement is in direct contention with the investigations original goal of creating a forecasted product.

I do believe I could of pushed for a more conceptual product, however I also think the final concept contains are good mixture of 'blue-sky' and reliability. Admittedly the product form is relatively simple, however this was done to increase the users perception of the reliability, robustness and ease of use. I do think there is room for development of the form.

Through analysis it was established that the Tait has potential as an OEM (original equipment manufacturer) in the future and for this reason the amount of branding present in the proposed concept is toned down. Another major component of Tait's current portable radios is the use of injection moulding. As a conscious decision and reaction to manufacturing and product trends I choose not to use injection moulding, siting its low recycle-ability.

The proposed user interface is not the focus of this investigation; however what was presented was designed in reaction to the users desire for a professional tool that is simple and easy to use. The interface has limited functionality due to the requirements of the users, such as: high visibility screen (black text on a white background) and different screen modes.

This project proposes a police communication device that has many functions beyond audio communication, ranging from biometric identification; image and video recording to a form of Global positioning (GPS). On question that constantly arose during research was 'should this product be a communication device with added features or should it be a stand alone communication device only'? In my opinion the police of the future will require a communication product that has only one function, audio communication, this would be used in conjunction with other device. This is because currently and in the future an officer's radio is their lifeline. One of the research participant said, "A gun can run out of bullets, a taser can go flat but I can call for back up with my radio, that is what makes it the most important piece of equipment that I have".

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Declaration Confirming Content of Digital Version of Thesis

I confirm that the content of the digital version of this thesis

Title: **How Will Robocop Communicate?**

The design of a conceptual portable radio communication product for the NZ Police in 2018

is the final amended version following the examination process and is identical to this hard bound paper copy.

Student's Name: Frazer Donald Ellis

Student's Signature: 

Date: 03 - March - 2009

