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i Preface

You hold in your hands Part 1 of the Design Document for the proposed real-time multiuser online application: Frontier.

Information relating to all planning aspects of the project for my MA award in Online Communication can also be found in this document.

Information relating to the projects contents are briefly described in relevant areas of this document but for the full breakdown of proposed features; please see Part 2 of this document – which is a separate document (usually located in the same place you obtained this document such as from the Frontier website¹, the physical folder handed-in or the Frontier development blog²) that is due for completion as part of Unit F: Stage One Application Development.

I have tried to keep details to a minimum in this document while at the same time providing enough information to give some idea of what the full Frontier experience might be like. I have also tried to write it in an interesting and jargon-free way where possible.

Hope you enjoy reading all about Frontier and would very much like to see you get involved³.

James Field
Frontier Project Manager/Developer/Artist

¹Frontier main website is located at <http://frontier.lincoln.ac.uk>

²Frontier development blog is located at <http://frontier.lincoln.ac.uk/devblog>

³Get Involved by visiting <http://frontier.lincoln.ac.uk/getinvolved>

ii Who this document is for

Anyone involved with the making and marking of Frontier will find all the information they need to understand what components and functionality will be included within this project and how they will come together over the specified time-scale.

This document will also appeal to those generally interested in the project or looking for an example project planning/design document structure to adopt for similar projects.

Everyone is welcome to read and comment on this document but please note that features proposed in this document may not make it to the Final Application which forms the majority of my proposed submission for Unit G of this award.

1 Abstract

Frontier will be an application where users have the ability to form communities in a simulated world much like how they would using the “real world” metaphor of colonisation. Users will also be able to continue using some features of the application via their mobile device allowing them to take a part of the experience with them when they are away from the computer.

There are 2 overall aims for the project:

- To produce a functioning multi-user, feature-rich, fragment of the proposed full application with scope to produce a fully-fledged multi-user community building application at a later date.
- Secondly, to investigate mobile applications with the purpose of being able to produce content demonstrating how the different platforms will affect application design, interaction and integration.

A reasonable amount of time will be spent making the application’s engine as scalable and adaptable as possible, ensuring that creating/maintaining content and interactions will be easy and manageable. The engine should also be capable of being reused and customised for different, future, applications as well as allowing the full application to be developed.

After conducting research into development platforms in the Competitive Analysis & Technology Review^{1,2} unit of this award, I have been able to draw a number of conclusions one of which is the platform that is most suited to developing an application of this nature.

I chose Flash to create the game engine as it became apparent it could handle everything I planned to do very well and will have the added advantage of not requiring any software downloads for a user to start their experience, ensuring that the application is as accessible as possible. Accessibility and a seamless experience are among my highest priorities and Flash will aid me in creating such an experience due to Flash’s massive world-wide plug-in penetration.

Although I only intend to produce a fragment of the final application for the practical side of this award, I want to demonstrate how what I’ve researched has shaped the proposed way Frontier will connect with the user and how in turn they will connect with a community of people for fun and learning.

Distinctions between what I intend to actually produce against what the final version of what Frontier would be like if it became a fully functioning application are noted in Chapter 4: Project Content & Structure and covered in greater detail in Part 2 of this document.

There will be an underlying sense of belonging like never before experienced. A user will belong to a colony that has a dynamic physical appearance and static physical location. Their colony will have neighbouring colonies that will remain the same each time that user signs into the application. To visit a colony the other side of the proposed game world will require orientation skills and a user could pass through many other colonies before reaching their destination. Encouragement will be given to users to visit other colonies created within the application and rewards will be inbuilt to ensure this could happen.

Colonies will take the form of plots of land, of which, the users have some control over how they are developed. Each user will have his/her own personal plot of land, which only the owning user can develop. When it comes to developing the colony; a simple building package will be included so there is scope to create a unique place to visit. Meetings and voting within each colony can be carried out in the 'Recreation Area' which will be centre of all community-related events. Unlike other, less dynamic community applications (as listed in my Competitive Analysis & Technology Review¹), my proposed application will feature a 2-phase application wide goal that all users, through their colonies and their own contributions, will work towards. This is an attempt to engage the user and employ some core aspects of games design to make the user want to return to the application frequently. These phases are important to my overall aims and are outlined in Chapter 4.2: Application Phases.

To facilitate this, users and, colonies as a whole, will have roles assigned to them. The roles for the individual user will be day-to-day task based and quite menial, but they will be quick to complete allowing adequate free time and to explore the leisure-based activities planned for the application. The roles assigned to the colonies constitute the culmination of each individual's daily input from their assigned roles. Roles will all relate to the management/extraction/consumption of resources and the creation and sustention of a new ecology. There will be a reasonable selection of colony and relative individual roles. For a more detailed break-down of roles and tasks, see Part 2 of this document.

Each user will have a customisable avatar that will be their representation in the world. Each user will also have their own funds which will enable them to purchase items for their private space or for the colony as a whole. Collaborating funds will allow for much quicker development of the community space and help towards the colonies and the applications overall goals.

Visually, the application will be created in pixel-based isometric projection. The style of the application will lean towards the popular trend of cartoon based isometric graphics as found in similar applications such as 'Habbo Hotel' and 'Mokitown'. This style is particularly popular with the main target audience of 11-16 year olds because it is visually intriguing as I discovered from the Competitive Analysis & Technology Review¹ unit.

As for my second goal: mobile integration; this area of digital media appears to be amongst the contenders for "the next big thing", therefore, it would be wise of me to investigate the use of mobile devices to add greater accessibility to the main proposed application.

Possible types of mobile application are:

- Additional content – The user could investigate a special ‘offline’ experience using visual elements from the main application. No communication system would be required for this level of mobile application development; however this is the least seamless of the four options as it will not allow user-created objects nor will it allow communication of any sort to feature in it.
- Enhanced content – This could take the form of games that will allow the user to work/play to earn extra money for use in the main application. A non real-time communication system would have to be created between the mobile client and the main flash client to handle this. My research and outcomes from the forthcoming Stage One Application Development³ unit will reveal whether this is going to be possible or not.
- Extended experience – By far the most ambitious of the options available. Only once relevant research has been conducted will I know the plausibility of creating such a feature. Basically, this would consist of the same world as found in the main application but rendered on the mobile device. Communications would be in real-time and movements updated at set intervals. Interactions between world and user as found in the main application may even be transferable to the mobile platform and this would create the most seamless experience possible between the platforms.
- Non-interactive content – This is the standard mobile content of wallpapers, themes and ring tones that are available from similar applications at present. There should be provision for these as from a marketing point of view; they are great money making assets. They don’t however, add to the overall experience of the main application and will have development time apportioned to them appropriately.

Only through thorough research and advanced prototyping from the forthcoming Stage One Application Development³ unit will I be able to gauge what is and what isn’t possible with this section of my project. I will also take into consideration proposed future mobile technology so my application has a plan to sustain it.

There are many more proposed features which will further enhance the application and will help to make it the most realistic community experience on the internet. They will all be treated in Part 2 of this document.

¹To view the work undertaken for the Competitive Analysis & Technology Review unit; please visit <http://frontier.lincoln.ac.uk/unitD/>

²To see what was required for this unit; please see my Learning Contract available at <http://frontier.lincoln.ac.uk/unitA/LearningContract.pdf>

³To view the work undertaken for the Stage One Application Development unit; please visit <http://frontier.lincoln.ac.uk/unitF/>

2 Goals

There are several reasons why I have wanted to create a project of this nature and magnitude for some time now. From a personal point, my primary goal is simple: I want to create the grounding for a product that features excellent scope for community establishment and sustainability, cutting edge communication systems and one that is free from any license or copyright restrictions, something I wasn't able to achieve during my BA (Hons) Degree in Interactive Multimedia.

I also wanted to create an application that stands as minuet testament to nature's effortless complexity. I wanted to include elements that feature nature-esque dynamic relationships with counterparts but at the same time, keeping them easy to achieve and understand so that the target audience experiences them as effortless as they experience and interact with nature itself.

I am fascinated by nature, and I am particularly interested in the way humans have manipulated it to ensure our way of life. I'm not talking about genetic manipulation, I am more concerned, when thinking about what to include in this project, with agriculture, forestation and ecology.

Aside from personal goals, there are also a number of reasons why this project should be realised. The present provision for community applications¹ is split between the functional, user-generated content of applications such as 'MSN Groups'² (<http://groups.msn.com>) and the visually beautiful but ultimately less dynamic applications such as 'Habbo Hotel'³ (<http://www.habbohotel.co.uk>). The application 'There'⁴ (<http://www.there.com>) does attempt to mix wonderful aesthetics with community-based activities but ultimately feels like a game due to its 3D visuals and chatting, which is the fundamental aspect of community life, is still very clumsy in 3D despite them making the best effort I have come across.

I hope to fuse the two aspects outlined above, to shape an application that not only looks pleasing, but also encapsulates the fundamental aspects of community creation and sustention through functional features that seamlessly blend in with the proposed applications visual themes.

¹Based on my Competitive Analysis & Technology Review, details of which can be found at <http://frontier.lincoln.ac.uk/unitD/>

²<http://groups.msn.com/>

³<http://habbohotel.co.uk/>

⁴<http://there.com/>

There is definitely scope for educational elements to be emphasised in my proposed application, with subjects such as maths, science and most importantly, citizenship being covered to some degree. Citizenship is one of those subjects that does not have its own associated lessons and award within the National Curriculum in the UK.

Instead, schools have to make sure they integrate the criteria of the citizenship framework into their current teaching scheme. An application such as the one I propose could help with key elements of citizenship as forming a community and becoming a conscientious, functional, democratic and successful member of society are part of the core values and reasons for its being.

I have written a proposal for how Frontier could fit into the National Curriculum, including a breakdown of how lesson time could be allocated to using Frontier in class. For information on this aspect, see Appendix C: Frontier in the National Curriculum.

Mobile devices are going from strength-to-strength in terms of both worldwide sales and improving technology. The scope for developing feature rich, visually interesting and highly interactive experiences is now very much a reality and in response to this, Macromedia (now Adobe) released an incarnation of their globally popular Flash Platform for mobile devices. Flash Lite is its name but don't let the suggestion of it being underpowered cloud your judgment as Flash Lite 2 (latest release) includes the same core features as PC-based Flash 7 with some additions tailored to mobile devices and only a few, understandable, losses.

At present, Flash Lite doesn't have any heavy-weight, serious or boundary pushing applications to showcase. Whilst researching the best of Flash Lite applications I found a particular site¹, which demonstrated that the direction of most of the award winning Flash Lite applications appears to be towards providing visually attractive services such as web-based news, weather, RSS and non-web-based applications such as organisers and lifestyle tools.

There are a growing number of simple games, but again, there's nothing really of any substance. Obviously, a user will be reluctant to spend as much time on their mobile device as on their PC so creating a Role Playing Game for example is possibly not a great idea. It will be up to me to find a balance between getting the most out of the experience in my proposed mobile tie-in whilst ensuring it is well paced and efficient.

¹The site in question was a Flash awards site: http://flashmobilegroup.org/?page_id=17

3 Why Frontier?

It wasn't easy thinking of an idea that could combine a theme with the features and functionality I had planned. In fact, it took me nearly 2 years to discover a theme which was suitable. For chronological accuracy section 4 of this Chapter: Previous Approaches, for details on the projects development, whilst section 3.2 of this Chapter: Theme, describes how my original ideas mutated and changed direction after viewing a fateful television programme.

The content of these sections is relational to the outcomes found from the Competitive Analysis & Technology Review unit and features some elements from the Social Aspects¹ unit.

3.1 Visual Style

As soon as 3D was ruled out for a possible candidate for visual style, there was only one other perspective I wanted to use. Not because I am closed minded to other possibilities, but because I have seen how popular isometric perspective can be. The Competitive Analysis & Technology Review featured 2 of the most popular places for my target audience to "hang out" and both of them are presented in isometric perspective. This is the only reason they stand out from other, similar applications, and this is due to their intriguing visual style which in turn leads to good interaction models between the user and the applications environment.

More recently I came across a community application that utilises a 2D side-on visual style, and, for a short period of time (prior to actually using it), I thought I may have another contender and visual style to consider, but it didn't take long to dispel. I don't know if it was the poor implementation of faketown.com, but the whole experience seemed as flat as the perspective and scope for exploring was so pointless and uninspiring.

With my theme now decided, and exploration been a key element to it, there is only 3D and 2.5D isometric that can successfully carry this off. I want the experience to be multidimensional to allow for more screen space to have environmental interactive features and I have already presented my rationale for using Flash so it has to be isometric perspective for the proposed visual style.

¹To view the work undertaken for the Social Aspects Review unit; please visit <http://frontier.lincoln.ac.uk/unitC/SocialAspects.pdf>

The final element to decide when finalising my visual style was the debate between pixel-based and vector-based. I have been learning towards pixel based since the outcomes of my Competitive Analysis & Technology Review, as there could be scope for user generated content and this is something harder to provide provision for if vectors were used. It takes great skill to draw accurately in an isometric style using vectors.

Bitmaps have the added advantage of being able to stream into a Flash movie dynamically which could be how my planned customisation feature will work. This would save download times and make the whole application so much more dynamic and “updateable”. Bitmaps would also be the preferred media choice for the mobile version as vectors could slow down devices due to their underpowered processors.

Although vectors have the ability to scale well, the advantages for using their pixel counterparts outweigh any positives for vectors by quite a margin. Every decision regarding the proposed applications visual style has been rationalised and the outcome is clearly: pixel-based isometric perspective.

3.2 Theme

I had already ascertained the user viewpoint and visual style. I also had a good idea of the kind of community creating/sustaining features I wanted and needed to include in this project. What I was missing was a common theme to bind them together.

Prior to Frontier, my current development application theme was Wootopia (see section 4 of this Chapter: Previous Approaches for more information). Wootopia however was missing a crucial property: an exciting goal that all users could and would work towards. I needed a theme that was modern, achievable in real-life and interesting to the target audience. I was stumped and although happy to continue developing Wootopia, in the back of my mind I was always waiting for something else to come along. Fortunately, for me and the project as a whole, it did.

I was watching television one Sunday afternoon in March 2006 and, by chance, a programme about Mars was on. I wouldn't say I was a keen astronomer but I have always been fascinated by space and the universe, particularly the achievement mankind has enjoyed in this field over the last 50 years. I would consider man setting foot on the Moon as the human race's most pivotal achievement. Sadly the public interest hasn't endured and it's disappointing to see the technology developed for the space program primarily applied to weapons and defence.

This programme about Mars (sadly I have forgotten what it was called) was more than just the usual discussion of its characteristics; it was a serious look at how humans could reach Mars today, well set off for Mars anyway. According to the experts interviewed for the programme, we have the technology and knowledge to not just travel to Mars, but to stay there long-term and establish colonies. In fact, just travelling to Mars would be pointless considering the time it would take to get there so establishing colonies for research and a greater purpose (will get to this soon) is as much the target as getting there itself. A summary of this information can be found in Appendix B1: Reaching Mars: A simplified guide.

I found this quite amazing and exciting, but then the programme ventured into a new direction that quite simply stunned me. Once several colonies have been setup and transportation between Earth and Mars became easier, the colonists could start the 1000 year process of “terraforming” Mars. Using one of several models that have been written for this purpose, the human race could eventually change the planet until a point where Earth plant and animal life could live and thrive on

the surface of the great red planet. I won't discuss the details of these models here, but one particular model is covered in Appendix B2: Terraforming Mars: A simplified guide.

Then it hit me. I was looking for a theme that had a goal that required the efforts of not just individuals, but teams of individuals over time, and the terraformation of Mars required just that. I then started to think about if the criteria of other aspects of my proposed application may be met by this idea.

With renewed vigour and some excitement, I set about investigating if all the features I had proposed to include in my application could be implemented under the theme of the arrival at, and terraformation of, Mars.

3.3 Application Features

If the chosen theme of Mars could support the applications required community features that I outlined from the Competitive Analysis & Technology Review¹ then I could start Stage One Application Development as soon as this document is relatively complete.

Throughout this section I will discuss how each of the core and new elements from the Competitive Analysis & Technology Review could be implemented under the Mars theme:

3.3.1 Persistence of Presence

As I have already discussed in the Competitive Analysis & Technology Review, achieving this is fundamental to any online site, service or game. Allowing a user to create an account, password and profile is possible no matter what the theme. The only consideration linking this aspect and the theme is that it is consistently presented in terms of usability and aesthetics.

3.3.2 Real-time Communication

Communication is key to community development, which extends to colony establishment and sustainability so the concept of chatting between users has to feature in Frontier. As with persistence of presence above, there are no limitations to this functionality that could be imposed by the chosen theme.

In relation to the visual style, the chat aspect must obviously fit in to the chosen style. I envisage chat text to be encapsulated inside a bubble. The font and bubble graphic must be pixel based and will be 2D, so they will complement the visual style.

The Mars theme used in Frontier could allow for communication via walkie-talkies, satellite phones, or radio for staying in touch long distances in addition to the chat mentioned above which would simulate proximity speaking and listening.

3.3.3 Make the user want to return

Without any user feedback it is hard to guarantee that users will want to come back to an application based on my chosen visual style, but gauging how popular Habbo Hotel is, I can assume that if it is developed to a similar high standard, combined with the interactive features and the goals, it should be very popular indeed and users should want to come back.

With all the possible theme and community related activities such as goals to achieve and games to play, there really will be a lot to do. There is nothing I am planning that couldn't be done under the Frontier Mars theme.

In fact, if Phase 2 development is every reached (see Chapter 4.2: Application Phases), then users could see big differences to the overall visual makeup of the game world once terraformation begins.

Witnessing massive global changes will be something worth seeing and checking back for. Even Phase 1 should have users coming back to visit, especially if they are involved with tasks that take time to achieve, such as growing crops. There is even scope to encourage users to return often to check for problems with crops or machinery, but I must not make these conditions too dependent on the user's presence.

3.4.4 Mobile Technology

Again, the Frontier theme is not going to restrict anything I can achieve on the proposed mobile platform. The only element which could prove fatal to mobile devices is the visual style. Isometric on the computer will work well because users have the mouse and the point and click interaction model.

Users on mobile devices only have a 4-way directional button to control an onscreen cursor. This could prove disorientating when applied to moving the cursor around an isometric world. Only through prototype development and user testing will I understand if this is acceptable or not.

3.4.5 Roles & Responsibilities

This is possibly the area with where the newly adopted Mars theme will prove the most beneficial. Part of my plan to keep users interested will involve them having a role imposed upon them, which is derived from the overall task imposed on the colony. Each colony is working towards an application-wide overall goal, something I was having difficulty making interesting with my previous themes.

There are lots of interesting processes that need taking of care of during the colonisation of Mars. Some of the processes will include: making a controlled greenhouse effect, creating/gathering of fresh water for all the users, and food for all users that will be grown in the biospheres. There will also be tasks such as materials excavation, processing and exporting, and special growing biospheres where the first plant life will be cultivated ready to be planted on the planet's surface (outdoors) when certain conditions are met. See Part 2 of this document, for a detailed breakdown of roles and tasks or Appendix B2: Terraforming Mars: A simplified guide for an outline.

Tasks such as these are far more varied and interesting in Frontier than in other themes I had planned to use, and I believe they will aid in keeping users returning as the roles could change as the application-wide goals are met.

3.3.6 Chosen application development platform

As outlined in the Competitive Analysis & Technology Review, Flash is capable of importing and manipulating isometric pixel-based artwork. The Frontier theme will have very little impact on the already-decided visual style, which means that Flash is up to the job.

3.4 Previous Approaches

The underlying theme for Frontier didn't happen overnight. I have been working for 2 years on the theme for this application. This section will visit each of the major ideas I have visited in the period before I was happy enough with an idea to start writing this document.

3.4.1 Lego Chat Advanced

My first idea was spawned soon after I graduated in the summer of 2004. I had planned to start my MA straight after the summer and I started working on a concept to take what I had developed during my BA, which was the 3D Lego Chat application, and begin bolting on community aspects.

I was planning to allow each user to have their own space in a Lego town and they could "build" their house out of 3D Lego bricks in a similar style to how I constructed my Lego town for my BA. I was also going to allow the 'town founder' to have control over the road layout, the placement of community buildings, and assign how many users could move into town and where their plot of land would be.

Even at this stage in my ideas development I was thinking of imposing roles on the users. In fact, this idea of role assignment stems all the way back to the summer of 2003 when I was planning the first incarnation of Lego Chat. It turned out that I had to concentrate on just the chat element due to time and knowledge restraints.

I was planning to have special areas based on jobs you could do in the Lego town sets such as construction, fire service, police, trains and dock yards, but even with such choice, there wouldn't be much variety in the kind of tasks set for each role, and there was no real rewards for working towards community-wide or an application-wide goals.

Eventually, my underlying concern about the copyright issues regarding the whole Lego brand ruled this option out of contention. I had learned the hard way with my BA project and I wasn't about to spend 2 years on an application that I could not show outside of an educational establishment.

3.4.2 Animal Crossing Community

Still sticking with 3D, as at this point I still had faith it was the way forward with the web, I came up with the idea of building a community site for the popular Nintendo Game Cube game: Animal Crossing. At this stage I was working in a partnership with Greg Brant and it was winter of 2004.

We wanted to build a 3D application that was heavily centred on developing a community through vast amounts of user-world and user-user interactions. The main issue was however, we were short of a theme where 3D was going to add to the experience as opposed to it potentially getting in the way.

As 3D is very difficult to produce material for so we decided to adapt the approach I used for my BA and borrow an already established theme and begin creating a community experience from it.

Animal Crossing was perfect as it was a simple 3D game with lots of user and community based features, although not multiuser, and it had an established worldwide fan base. Copyright issues from the previous theme idea start creeping back in so I started rooting around for some permission.

After a quick search, I stumbled across what I thought to be the official web community site for the game Animal Crossing. It was so professionally presented and the URL seemed so official¹ I got in touch with the administrator of the site, assuming him/her to work for Nintendo of America. The reply was positive although I was now a little suspicious as we were given the go-ahead without any real concern for the protection of the brand. Sadly it transpired that it was an unofficial site and we decided that we were going to have to stick to an original creation if we were ever going to produce this application.

To compact our disinterest in this idea, Director was disappearing into less prominent places on the Macromedia website at such a rate, it became clear that a huge application of this nature would be far too risky to develop on a platform in its twilight years. This sealed the fate of a flawed idea from the start.

3.4.3 Wootopia

It took over a year for the next theme to be developed and by now the state of the technology had made a few decisions for me. I was also back to working on my own as Greg had left for pastures new. Director was still clinging on there, but had not received an overhaul when Macromedia announced Studio 8 was to be released. MUS, the free server that shipped with Director 8.5 was no longer supported and hosting companies pulled the plug on server hosting.

Although it was looking grim for Director, it was still possible to develop a community-based application, but with some major advancement in Flash, it was looking like, even before I had undertaken the Competitive Analysis & Technology Review, I was going to have to switch development platforms.

The ability to produce Flash-based content for mobile handsets started looking very intriguing and appealing. There was genuine scope for a portion of the community experience I was sorely trying to create, to be adapted to work on the mobile platform. This meant that users could carry a part of the application with them. Initial ideas for this content were dependent upon future research to what levels of communication Flash on mobiles could achieve. At present they range from downloadable content to a full on interchange of communication. The higher towards the latter I could achieve, the greater the meaning of developing mobile content for this project.

Wootopia as a theme would see an isometric pixel-based world, similar to Habbo Hotel, but users would have vast amounts of control over how the town would be constructed. A full world editor would be implemented to allow budding town planners to take the reins and create a unique place to visit. The visual style would be very much town looking with houses, town halls, places of work and tourist attractions.

A lot of the core values that Frontier will employ originated from this idea, so I won't go into too much detail as I'll only be repeating myself later on in this document. Ideas such as having a physical location that remained the same as other towns were constructed around yours. Wootopia was the first theme to include notions of visiting other towns as part of an application-wide goal of collecting postcards.

¹<http://www.animalcrossingcommunity.com>

Development went very well for a prototype and I was enjoying using Flash as the Platform and testing out various multiuser servers. I was never truly happy with this idea however, as there was never much scope for imposing any interesting personal, community and application-wide goals. The menial tasks that were proposed were very similar to those outlined in the Lego Chat Advanced section and wouldn't entertain for long.

This idea would have stuck had it not been for the fateful intervention of television and the resulting invention of the Frontier theme.

3.5 Summary

Throughout this section I have been justifying using the Frontier idea as the underlying theme for my proposed application. I have shown how the idea came about through literally years of development and refinement and how ideas were cast aside in the process. I have also discussed how Frontier would incorporate itself into the key and original features as outlined in my Competitive Analysis & Technology Review.

Personally, I am very happy with the theme as there is vast scope for all the interactive elements, games and user experiences. It is a fun and interesting area of modern day possibilities and should entertain and keep the target user group coming back for more.

Soon after thinking up the idea, I started contacting various noted persons and bodies involved with the planning of missions to Mars and the terraformation process and they were all keen to help and send information as they can see the potential Frontier has for bringing the subject of Mars back into the public eye, especially for the next generation of could-be astronauts/mission commanders.

4 Project Content & Structure

Obviously, what I have proposed is an ambitious project with many separate systems/function and prototypes required to work together or be merged together to obtain the desired result. This section lists the actual work I will be submitting for assessment for units F & G of my MA Online Communication award¹.

4.1 Project Components

Frontier will consist of the main prototype application on PC/Mac, various Mobile prototype applications, a database to power the whole project, a supporting website, a development website, documentation and promotional material.

4.1.1 PC/Mac Prototype Application

A Flash file embedded in a webpage pop-up window accessed from the supporting website (see 4.1.4). This file is where all the application features and interactions are located and where the user will be spending most of their time.

PC/Mac applications will communicate with each other and PHP scripts which will in turn connect to the MySQL database for retrieval and setting of data. PC/Mac applications will also communicate with Mobile versions of the application but in what way is still to be investigated and decided. The scope of what I hope to achieve for this award/project is outlined in Chapter 4.2: Actual Project Application Development.

4.1.2 Mobile Prototype Applications

Using Flash Lite I can create a special version of the application that will run on some mobile devices. During the course of my prototyping experiments in Stage One Application Development, I will be able to specify what level of communication/interactions I can achieve between the PC/Mac application and the mobile application.

¹For a list of all work submitted for this award; please visit <http://frontier.lincoln.ac.uk/development/maWork.php>

It could be that I require a number of different mobile applications to accommodate for supported features on each device such as differing screen resolutions etc. A report will be included on the website produced as submission for Stage One Application Development.

4.1.3 Database

I will be using a combination of PHP scripts and a MySQL database to store everything from a users account details to the current state of the planet's atmosphere. Every feature of Frontier will be dynamic and highly interactive. The full breakdown for the database structure can be found in Part 2 of this document.

4.1.4 Supporting Website

The PC/Mac application will need a HTML web-presence to launch the Flash applications. This is where the supporting website comes in. It will serve not only as a launch pad for the application, but also inform users of news, new features, a support section and gallery images of users experiences. I plan to work on this site during the later stages of the Final Application Prototype & Evaluation unit of this award.

4.1.5 Development Website

Whilst Frontier is in development, a number of people, groups and companies are interested in its progress. I plan to keep these parties informed by creating a Development Website. On this site, interested parties will find out information on the latest development prototype, view images of developments, test the latest functional prototype and leave comments about what they like, what this dislike and if there's any feature they would like to see in the project.

4.1.6 Documentation

With a project of this magnitude and importance, there will be of course a number of documents produced to inform, help develop and research various areas of the project.

This document you are reading is my plan for the development and construction of Frontier. There will also be an evaluation of the project once it has been completed. To keep track of development, and to satisfy the criteria for my MA, I am also keeping a log which will eventually take the form of a blog that will be accessible from the development website.

4.1.7 Promotional Material

I intend to at least look into how I could advertise and promote Frontier. I won't have time to include a full promotional package, but I will be writing about what kind of materials I could produce to help gain exposure.

There are the obvious approaches such as internet and magazine advertising but I also want to think about new and interesting ways of keeping users interested whilst at the same time attract new ones.

Ideas I've had so far include the ability to be able to download your avatar as an image/animated gif for use on message boards, have stickers, stationary, key rings printed off featuring items/avatars/buildings from a users colony/community. Maybe even special edition versions if that user's colony is a high achiever of the proposed application-wide goals.

Throughout the development process I will be constantly thinking of ideas and will include any decent ideas in the Frontier Development Blog.

As mentioned previously, the completed Frontier project would be an ideal candidate to link in with the National Curriculum in the UK. Therefore, promoting it to the education sector would be something else to consider. Until such a time where the project would be in a complete enough state to actually distribute, I will skip this aspect of the project but as with general public advertising, if I have any decent ideas on this subject; they will appear in the Frontier Development Blog. I will also have schools input via user testing throughout the projects development so I will have access to people with knowledge of how best to achieve promoting to this sector.

More details of how Frontier could be used in schools can be found in Appendix C: Frontier in the National Curriculum.

4.2 Actual Project Application Development

The first actual interactive application prototype will form my hand-in for the Stage One Application Development unit. As this is essentially a milestone prototype, a full breakdown is located in Chapter 5.1: Planned Stage One Application Development.

The remainder of what else I intend to produce in response to this project will constitute work submitted for Unit G: Final Application Prototype Development¹ that is essentially this awards' major project.

One thing to keep in mind when reading this I am not making the whole proposed Frontier experience. There simply isn't the time or manpower available for such an undertaking. I will however, demonstrate how all my findings from my previous units have helped shape the final direction of Frontier in various points in Part 2 of this document, in the Frontier Development Blog and in my Project Evaluation Document².

There are a number of components that I'm going to include that will constitute my submitted work for the Final Application Prototype unit and it's not just work that has visual representation or the end user will be aware of. So to get into perspective what exactly I'm going to produce, the following sections detail each component:

4.2.1 Get Involved (stage 1)

As a starting point, I need to produce a section of the experience that introduces the user to the game engine and mechanics in an interesting and representative way so I'm going to construct the actual part of the game where the users first arrive through the doors at Frontier... literally.

However this initiative is going to be a two stage process and before they actually set foot in the game world they need to establish the appearance of their avatar (which will form the visual representation of that user throughout the entirety of their experience). This will be achieved in the first stage by directing users to an interactive character customisation application fragment that I plan to create and publish on the Frontier website shortly after the completion of Unit E: Stage One Application Development.

¹To view work undertaken for the Final Application Prototype & Evaluation unit: <http://frontier.lincoln.ac.uk/unitG/> (when completed).

²The Project Evaluation Document forms part of my Final Application Prototype & Evaluation unit (see above).

As another way of getting users involved and enticed into using Frontier before the completion of the final prototype fragments; is to allow them to customise their eventual living space. I want to produce this as it will demonstrate some of the environmental editing functionality to users and it will also allow me to ensure I can achieve this editing ability in a small, manageable way.

I also plan to produce a few simple mini games on the website which will be themed around the visuals and functionality of Frontier. These are independent of the overall experience but will no doubt draw users to the site and keep them involved. I may even be able to outsource the production of these as they are only a very small part of this initiative.

4.2.2 Get Involved (stage 2)

Once the user has created their avatar they can then enter the final stage of the Get Involved initiative and that is to explore the base camp on Earth where the Frontier mission will lift off!

In this multiuser environment, users can talk to each other, visit each other's personal living quarters, explore the hanger, recreational areas & launch facility as well as join a colony/base and have democratic involvement in the colonies development plan.

There will be a countdown timer in the hanger (and/or launch pad outside) that displays the time left until a user embarks on their mission to Mars and join their colony/base. This is personal to each user and is only triggered when the user is part of a colony/base that is complete (has enough users) and is set to the nearest Saturday after all conditions are met.

4.2.2.1 The Journey to Mars

As a final part of the Get Involved initiative (stage 2), there will be a launch day and the actual journey to Mars itself. The launch day is a real-time event that is scheduled for a Saturday afternoon and is really quite brief. The users that are logged in have to make their way to the launch pad and board the launch vehicle. Once the last person is inside and seated, the doors shut and the final countdown timer is started.

Once lift off has been achieved and the users are in space (won't last more than a minute), they will be free to roam the ship and go their living quarters.

The whole process of launch day (except the travelling from quarters to launch vehicle) can be participated on via a users mobile device instead if they can not make it to their PC as can being able to explore their launch vehicle and quarters.

The actual journey, like the launch, is for a fixed amount of time (roughly a week). This is to get across to the user that it takes a long time to reach Mars. There will be plenty to keep them entertained along the way including:

- Explore their launch vehicle on their PC and mobile device.
- Play mini games (the number of which will be determined by time remaining on the award).
- Write in their explorers log and share with the world (using a social-network tie-in maybe).
- Learn about space travel and perform space walks.
- The ability to make amendments to their colony/base development plan (democratically).

These are intended features, but what is actually produced will be determined by time remaining on the award.

A full breakdown of all proposed features for Get Involved will be located in Part 2 of this document.

4.2.3 Mars-based Application Prototypes

Obviously, building the entire game is out of the scope of this award and the majority of the social aspects and mobile integration can be implemented into worked produced under the Get Involved initiative. However, I do plan to create examples of what various aspects of what the game world will be like upon the users arriving on Mars.

The planet and game world will not have a dynamic atmosphere or features and anything the users does in any application prototype will not have any lasting effect. These prototypes will merely serve as an indication as to what the user will see and do if the final version of Frontier is ever released and included as a reward for partaking in Get Involved.

Any colony/base planning and implementation will not transfer over and any group linking's the user made will be lost. This is a stand-alone (maybe still multiuser) experience but will carry elements such as a users avatars appearance and their starting location in their personal living quarters on Mars (that they potentially customised as part of Get Involved).

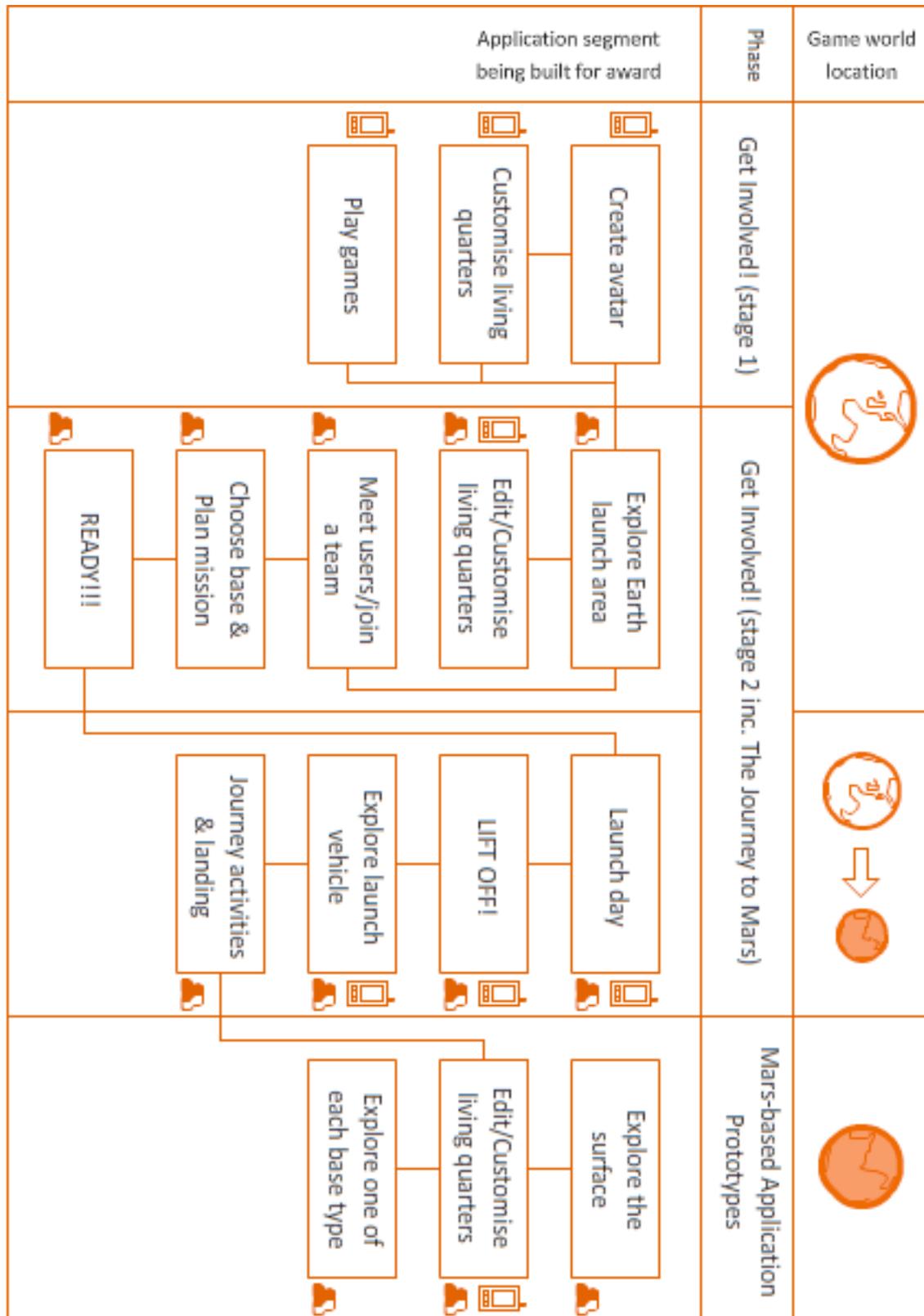
Ideas for this include:

- Explore the surface of Mars including areas of interest.
- Users should be able to make further alternations and change their rooms' appearance using both PC and mobile device versions of the application prototypes.
- Visit example colonies/bases (one of each type) and see the work going on there.

These are intended features, but what is actually produced will be determined by time remaining on the award.

A full breakdown of all proposed features for Get Involved will be located in Part 2 of this document.

4.2.4 Frontier Prototype Application road map



 Multiuser

 Available on mobile device

5. Prototypes & Visual Design

Developing something as complicated in terms of both aesthetics and functionality as what I have proposed is going to require a well-structured approach that will include many prototypes and visual designs/mock-ups.

This section covers what I intend to produce in response to Stage One Application Development of this award as well as features that will make it into the Final Application Prototype.

5.1 Planned Stage One Application Development

Possibly the most important prototype will be submitted as an entire unit for assessment of this award. Stage One Application Development is a key milestone for this project as I have to answer all the uncertainties, listed in this document, regarding proposed functionality in order to progress with the rest of the units associated with this award and indeed the Frontier project itself.

Therefore, the following content outlines the features expected for presentation/demonstration upon completion of Stage One Application Development.

The key points as requested by the Learning Contract for development are:

- Demonstrate the ability to apply knowledge relating to the production of the proposed new online community application, as specified in this document (Project Planning Document).
- Demonstrate a comprehensive understanding of the techniques and problem solving required in order to produce a prototype for the proposed new online community application.
- Demonstrate the ability to produce a working prototype of the proposed new online community application.

I have very little doubt that anything produced at this stage of the award will require anything less than a comprehensive understanding of techniques and problem solving, so there is no issue there. I do need however, to outline exactly what I hope to achieve for this stage.

Proposed Features/Goals for Stage One Application Development

- Isometric world that is drawn according to the contents of an appropriate table in a database.
- Any depth sorting issues must be completely resolved at this stage.
- Path-finding must be intuitive and effortless as possible with scope for changed paths, solid objects and other users.
- The application must feature a way to login to retrieve pre-defined, but nevertheless potentially customisable avatar.
- More than a single user being able to connect to the same world simultaneously is essential for this stage.
- All connected users must be able to move around and their movements reflected on connected clients screens with as little delay as possible (taking into account network type/traffic).
- The direction all users face must be a true representation of the direction they are facing as they move around the world.
- There has to be a textual way of communication built into the application that must be simple to use and allow for conversations to be held by 2 or more connected users.
- If a client leaves the room/disconnects from server, he/she must be removed from all remaining clients screens as quickly as possible.

If I can demonstrate the above, then I will have successfully completed Stage One Application Development. I will produce a report to include on the website for that unit which will cover how well I met my targets and discuss if, based on the timescale for producing the application at this stage, there will be enough time for me to produce the final application with all the interactions as outlined throughout this document.

5.2 Other Prototypes

As well as ensuring I can actually implement the necessary technology to make the core game engine Frontier requires to work, I also need to demonstrate competence in other areas that will directly affect the users experience in the application.

Many small prototypes have been produced so far but the following two examples are crucial to enable the development of anything past Stage One Application Development:

5.2.1 Climate Model Simulator

I needed to create an application that will return a baseline set of figures for the various regions on my proposed version of Mars as the composition of the environment changes due to user input/activity.

By building a climate model simulator based on proposed/projected figures from my research (see Appendix B2: Terraforming Mars: A simplified guide) I was able to visually project over how many years the atmosphere of Mars would take to change and when certain plant life can be introduced to the game world.

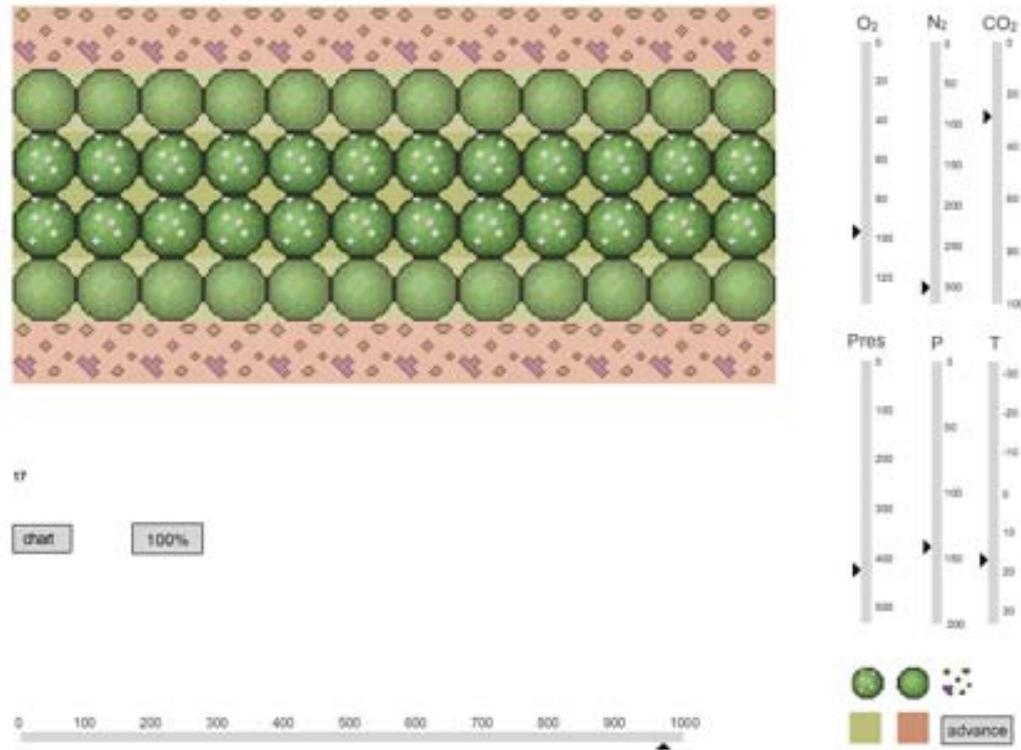


Figure 5.2.1a The climate model simulator interface

By ‘planting’ certain types of plant life in certain areas when certain atmospheric criteria were met, it was possible to roughly gauge over how many real years the atmosphere would take to change. This in turn will help me work out how to scale the overall time it would take for the atmosphere of the game world to change enough for terraformation to be considered complete.

5.2.2 Mobile & PC Test Applications

There is a great deal of functionality involved with a project of this nature, therefore there are a number of prototypes that have been created to test functionality of the game engine on both the PC and mobile platforms.

There is also a very simple multiuser prototype for the PC version to test the most important function of the proposed application and form the basis for my demonstration at the end of my Stage One Application Design unit.

5.2.2.1 Offline PC Game Engine Builds

The first prototypes are simply a way of me being able to test I can achieve, in a relatively small amount of time, what is required to make Frontier as an application work.

My first issue was drawing an isometric tile-based world and having the user move an avatar (character) by clicking the mouse.

This actually a reworked example found in the Macromedia Flash MX 2004 Game Design Demystified book (see Appendix: A: Bibliography). It is this example that is going to feature at the very core of the game engine for Frontier.

In its final iteration (before progressing to the next prototype), I had managed to enable the user to walk to a destination where they clicked with their mouse and if there were an obstacle in the avatars way, it would simply stop:

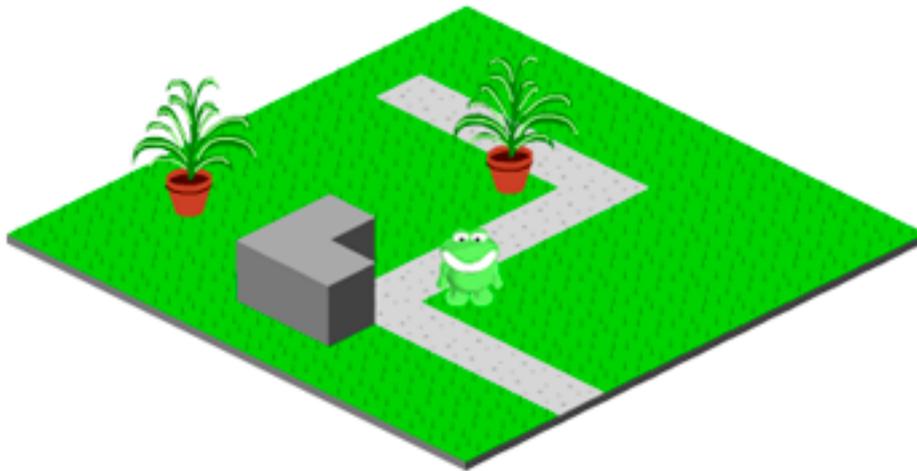


Figure 5.2.2.1a Although it may not look like much, this is the basis of what is to become the Frontier game engine

Although understanding the code behind how the world was drawn was a massive step forward, the example found in the book didn't provide me with the flexibility I required for true pathfinding, and this is absolutely essential if the isometric game world was going to feature in Frontier. The next prototype example was to address this.

Happily, it did. By implementing the A* algorithm¹ from a different programming language altogether, I was able to write a pathfinding class to use on a tile-based isometric game world in Flash and so the first prototype with this in place was a combination of the game world from the previous prototype and the pathfinding class:

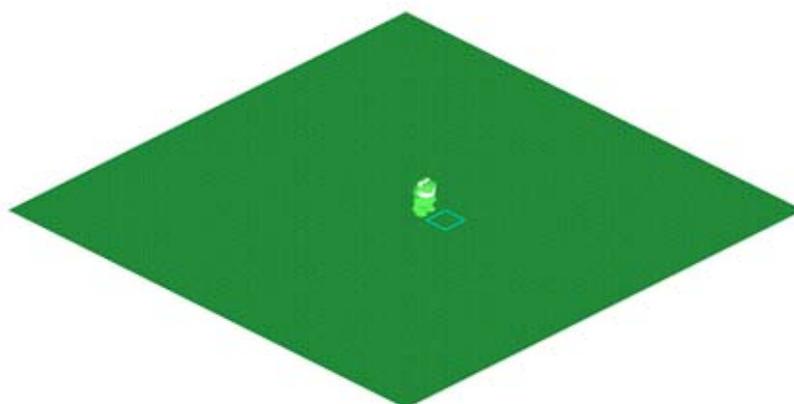


Figure 5.2.2.1b Improving the pathfinding capabilities of the game engine

Obvious improvements to this will come as the project develops and key areas for imminent improvement include character design more suitable to chosen theme (Frontier), character movement & animation, and obstacles for pathfinding to overcome.

At the same time as these advancements were taking place another branch of the proposed final application prototype was being considered.

Editing the game world and giving the user a chance to feel they're in control over certain aspects of their environment mean that placing and moving objects within the game world is required. With this in mind I created a simple world-editing prototype:

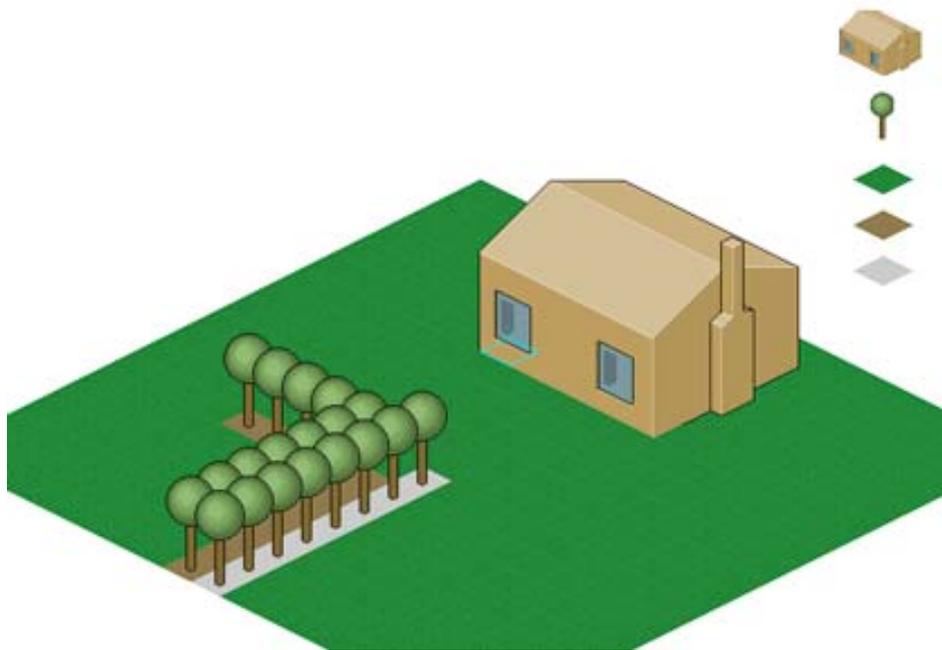


Figure 5.2.2.1c World editing at its most basic but this prototype proves it can be done

Obviously these prototypes were created earlier than my decision to go with a Mars-based theme, hence the seemingly inappropriate visual theme for Frontier.

But what the above prototype did show me was that editing the game world was possible and although I wouldn't be giving the user scope to place/move objects as large as houses in the final application, allowing them to control their environment is a huge step towards immersion and personalisation; something that is essential based on my research to this point.

5.2.2.2 Multiuser PC Game Engine Build

At the time of writing this document I have experimented with various Flash multiuser servers and at the point of writing this, I am still undecided over which particular server to use.

By the end of Stage One Application Development I hope to have a clear winner identified.

¹See http://en.wikipedia.org/wiki/A*_search_algorithm for details

5.2.2.3 Mobile Game Engine Builds

Please note that this particular section has been added to the document retrospectively in lieu of mobile prototype development not finished in time to be included in the Stage One Application Development unit review. However, it was completed in time to be included as a video demonstration that can be found within work undertaken for this unit.

Getting the game engine working on a mobile device is a huge step towards seeing if the idea of connecting the PC and mobile together in real-time is even feasible.

As discussed in the previous chapter, I will need to continue working on the mobile prototypes to ascertain what level of interaction and connectivity I can expect from this aspect of the proposed application.

One of the first steps was to see if the engine I had established for the PC version and the graphics that the engine used would actually run on a mobile phone. This is essential as if a totally different set of graphics was required and/or the game engine had to be scaled down significantly, it would spell the end of any interactive mobile version I have hoped to include with this project.

Thankfully, the engine did run on the mobile device I had obtained for conducting these experimental prototypes on (Nokia N70):

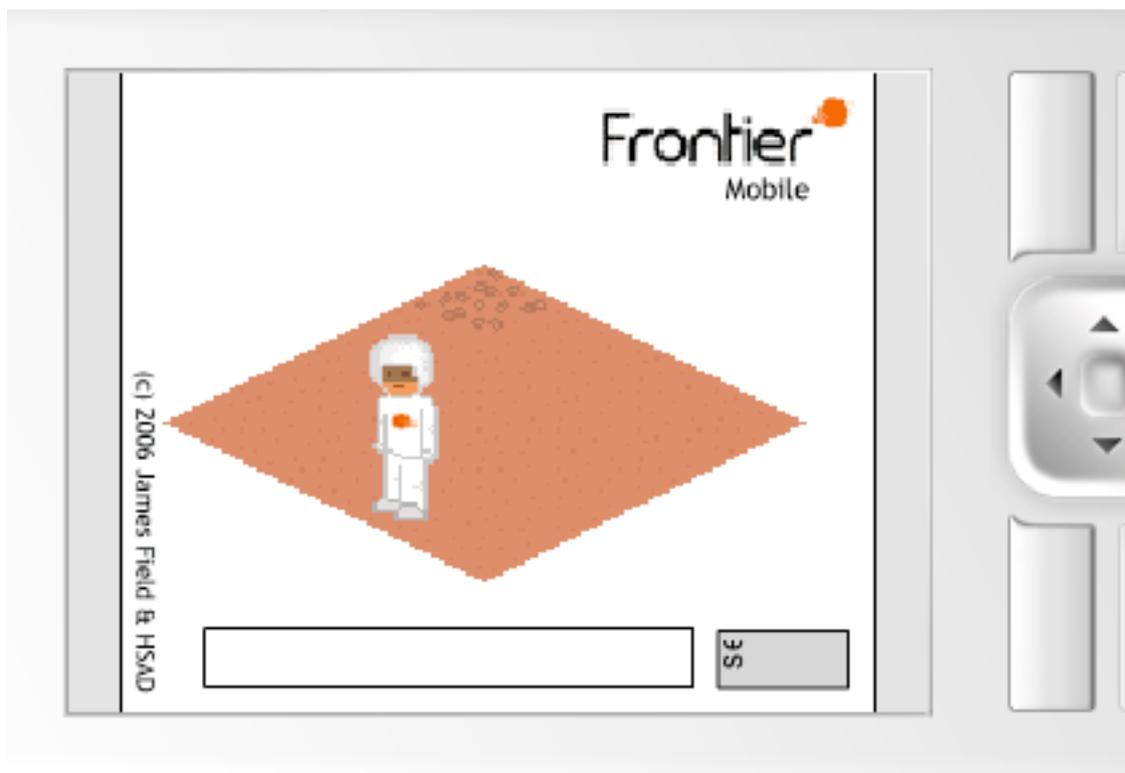


Figure 5.2.2.3a The very first mobile version of the Frontier game engine

One thing I do have to consider is the size of the game world featured on the mobile version. The device I was using has one of the highest screen resolutions available at the moment (176 x 208) which compared to a PC is painfully small.

Also, mobile phone screens are portrait as opposed to landscape which means to get the most out of the screen space the device will have to be held in the landscape format which means I will have to design any interface that uses the 'hotkeys' appropriately.

Despite these obvious limitations, I was able to ascertain that mobile devices can have an important role to play in the interaction and with mobile technology improving all the time and proposed screen resolutions of the Nokia N Series of mobile devices set to double in the forthcoming year, the outlook for mobile inclusion is good.

5.3 Visual Design & Mock Ups

As this project is still in its technical infancy, there isn't a great deal of pre-production artwork to include at this stage.

There are lots of sketches which act as guides for my technical development but considering this project is essentially a game, there is going to be a lack of this type of work due to a) the projects visual style (isometric) being very difficult to draw without committing to final pixel work on screen and b) the need to focus on the technical development to get this project off the ground at this stage.

However, I have included some of this visual design work below as an indication as to how the various visual aspects of the project have developed since the start of this project until time of writing:

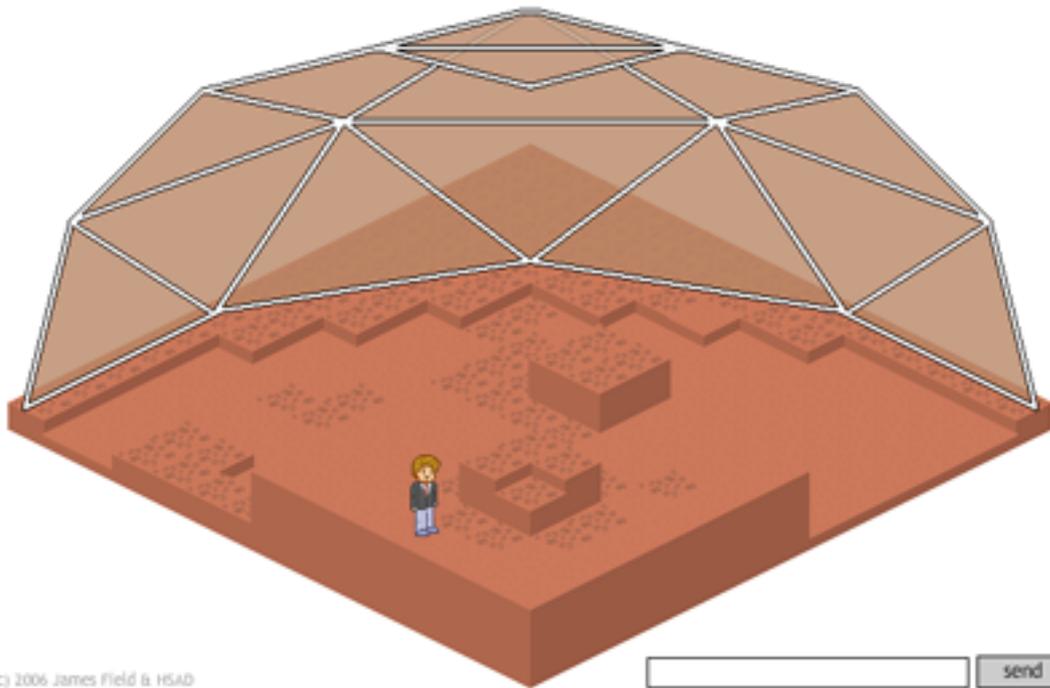


Figure 5.3a Logo development which has developed with the theme changes of the project and which is an important part of establishing a strong and memorable identity

disconnect

3 this ID of room joined

Frontier



(c) 2006 James Field & HSAO

Figure 5.3b A digital example of how a section of the game world could potentially look in the PC version

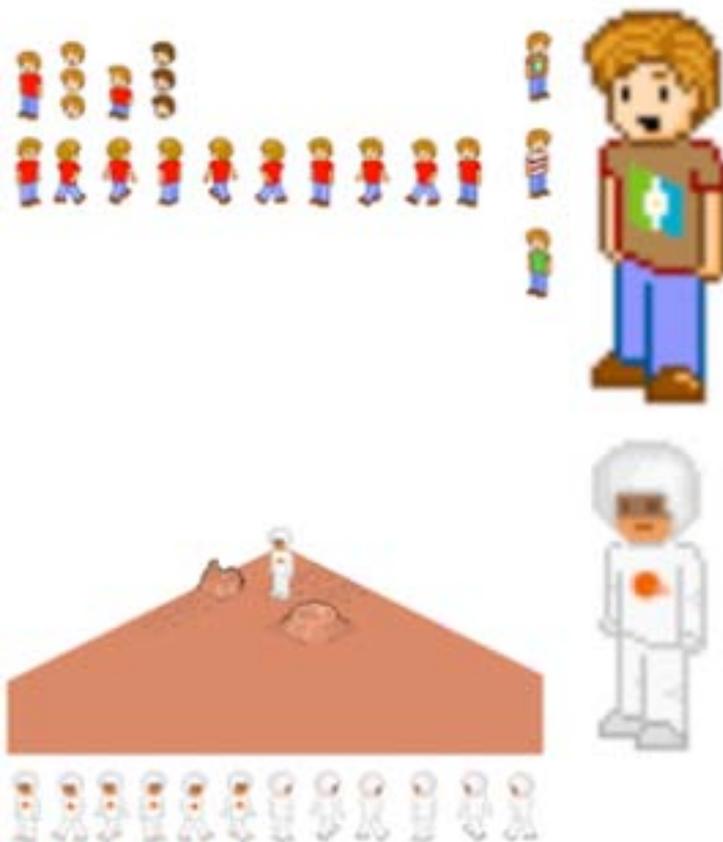


Figure 5.3c Character development and re-theming

5.4 Post-Stage One Application Development

Within this section I will cover what I know at time of writing I need to include after Stage One Application Development has been completed.

These are some of the larger, sundry, items that are not detailed in Chapter 4: Project Structure & Structure and most are still in the ideas stage at the time of wiring.

5.4.1 Conclusions

At the time of writing this, I will not yet know the outcome of the prototypes development. I will report back on this when the unit is complete and a full Prototype Review will be added to the outcome of the unit, which will be made accessible on the unit's website¹.

5.4.2 Story

I debated developing a history for Frontier as I am unsure if a fictional back-story would add to the user's experience.

On the one hand, having a brief history might put a few things into context for the user such as why they are there and what's happening on Earth in the time that Frontier is set etc. Conversely, forcefully exposing users to a history of how things are now could remove some of the instant accessibility of the application and give the user the impression they are playing a MMORPG. Although there are game design elements in Frontier, the core intended functionality is to develop a community building experience.

My idea for this aspect then is to prepare a history which could serve as an explanation or introduction to Frontier, but not give it a place in the applications structure yet. There are a few places it could reside such as on a special page of the supporting website or maybe in the application itself incarnated as a library or a book on the shelf of everyone's shared space.

Only through user testing/questioning will I be able to give this aspect of Frontier its rightful home. I might wait and see if any user asks about this aspect before questioning everyone as this would be an indication that it is an unnecessary distraction.

5.4.3 Interest Generation

Rather than simply wait for the Final Application Prototype to be completed before I give public access to what I produce for Frontier, I have enough knowledge and resources in my existing prototypes to create a prelude or preludes.

This will be beneficial to the projects success to really get a community fired up prior to launch of Frontiers' Final Application Prototype. By having already register accounts, I can ensure the account side of the applications database infrastructure is working well and communicating with various planned Flash prototypes which will aid in the production of the final prototype.

See Chapter 4.2: Actual Project Application Development: Get Involved for details of one example of how, even before Frontier is in a state to show, users will be able to get interested in the project.

¹To view the work undertaken for the Stage One Application Development unit; please visit <http://frontier.lincoln.ac.uk/unitF/> (when completed).

6. Development Schedule

Planning tasks and milestones are the most important part of large project that is set to span a large amount of time, and as this project is only part-time for me, it is essential I map out how I will apportion time to all aspects of this project.

Therefore, the following sections detail my planned development.

6.1 Pre-Stage One Application Development

From October 2005 until December 2005, the schedules here are written retrospectively based on entries in my development log. From January onwards, these were the tasks I set myself in line with the target dates outlined in my Learning Contract:

October 2005

Documentation	Application
<p>Review current Documentation and extract any relevant research. Sources include: old degree work, original MA paperwork and various magazine reports about the potential development platforms and their futures.</p> <p>Start logging all activities on this project.</p> <p>Create a proposal document to present to mentors and/or the subject committee board outlining the broad aspects of this project.</p>	<p>Have decided on which platform to use for development of a multiuser application.</p> <p>Choose a suitable multiuser server for the platform chosen.</p> <p>Create a basic development schedule for the learning of chosen multiuser technology.</p> <p>Think about and plan database for the development phase to include support for dynamically draw worlds inside chosen platform.</p>

November 2005

Documentation	Application
<p>Continue logging all activity both document-based and in terms of application development.</p> <p>Start working on outline of tasks to form eventual Learning Contract.</p>	<p>Take path-finding scripts recently developed and apply them to the isometric world that should by now be dynamically loaded from the MySQL database.</p> <p>Implement chat system as communication is a key element to Stage One and thereafter.</p>

	<p>Have met some of the goals from the basic development schedule for learning the appropriate multiuser technology.</p> <p>Have an animated isometric character working within the multiuser environment.</p>
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December 2005

Documentation	Application
<p>Continue logging all activity both document-based and in terms of application development.</p> <p>Continue working on outline of tasks to form eventual Learning Contract.</p>	<p>Investigate methods of resolving potential depth-sorting issues and continue working on outstanding multiuser server technology implementation.</p>

January 2006

Documentation	Application
<p>Have Learning Contracted units decided on and have started working on their contents.</p> <p>Continue logging all development activity.</p>	<p>By now the theme and potential names should be decided upon. Would then like to start producing graphics based on decided theme.</p>

February 2006

Documentation	Application
<p>Have some feedback on chosen theme and name(s) for the project.</p> <p>Start thinking about an 'awareness campaign' now the project has a theme and name (buy domain or register it with Lincoln).</p> <p>Contact mobile companies asking them about service charges for the various types of mobile content (once research is complete for the level of interaction capable).</p> <p>Continue logging all development activities.</p>	<p>Start investigating what possible interactions can be had between mobile clients using Flash Lite and the PC/MAC clients/server.</p> <p>Compile what development there is at this point for a mock-up Stage One application.</p>

March 2006

Documentation	Application
<p>Submit final Learning Contract for board in April. Run through it all with Sarah, Richard, Kev, Rose and John this month (schedule dates).</p> <p>Continue logging all work on development.</p>	<p>Ensure all outlined features expected in Stage One Application Development (title from Learning Contract) are in place and working well.</p> <p>Examine the possibilities of using server-side scripting for future reference.</p>

April 2006

Documentation	Application
<p>Now I have the full breakdown from my Learning Contract, I can start looking at the various written tasks which I'll start with Competitive Analysis & Technology Review as this will aid in ideas for the development of application and the eventual completion of the Project Planning Document.</p> <p>Continue logging all work on development.</p>	<p>Have work completed on the application up to the specification outlined for Stage One Application Development.</p> <p>Acquire a mobile device capable of supporting Flash Lite, preferably version 2.1 as 1.1 is based on much older ActionScript standard and it would be hard to convert so much progress into this syntax.</p>

Summer 2006 (May – September)

Documentation	Application
<p>Continue logging all work on development.</p> <p>Work on all written documentation that exists on my Learning Contract prior to the hand in of Stage One Application Development.</p> <p>Arrange to see John over the summer regarding social written aspects.</p>	<p>Keep developing prototypes for any interactions that have been identified since development ceased on Stage One Application Development.</p> <p>Attempt to get interactions between mobile phone running Flash Lite, Flash and the Internet.</p> <p>Have application ready for presentation immediately after I start back at work at the end of September.</p>

6.2 Post-Stage One Application Development

In far less detail than the previous set, the following plans are a broad outline of how the project will pan out after Stage One Application Development has been completed:

Month	Development
October (2006)	Start pre-Final Application Prototype involvement (see Chapter 5.4.3: Interest Generation) for details.
November	Continued development on Final Application Prototype and start work on Part 2 of this document.
December	Continue working on both Final Application Prototype and Part 2 of this document. Start Social Aspects Review essay.
January (2007)	Continue working on both Final Application Prototype and Part 2 of this document. Finalise details for pre-Final Application Prototype involvement. Finish Social Aspects Review essay.
February	Continue working on both Final Application Prototype and Part 2 of this document. Enrol on Research Methodologies taught course at Lincoln.
March	Continue working on both Final Application Prototype and Part 2 of this document. Complete work required for Research Methodologies unit.

April	Continue working on both Final Application Prototype and Part 2 of this document. Engage in user-testing for developments so far.
May	Continue working on Final Application Prototype and finalise details for Part 2 of this document.
June	Continue working on Final Application Prototype. Create full marketing strategy. Conduct final user-testing.
July	Write up evaluation and finish and hand-in all project work.

Appendices

A. Bibliography

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<http://www.google.com/mars>

<http://www.marsunearthed.com>

Practical/Tutorial Websites

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Web Database Applications with PHP and MySQL (2004) Williams, Hugh & Lane, David - O'Reilly

The Art and Science of Web Design (2001) Veen, Jeffery – New Riders

Don't Make Me Think (2006) Krug, Steve – New Riders

B. Research to Support Underlying Feasibility and Prototypes

Frontier's inception is owed initially to the fateful television programme (mentioned in Chapter 3.2: Theme), but only after further research was undertaken was I convinced that the underlying principles and methods proposed were sound enough to use for the rationale of this projects theme and core mechanics.

Although I researched many sources, two main areas (listed below) were of particular importance so they make-up the remainder of this appendix:

The Case for Mars
DR. ROBERT ZUBRIN

A book by the rather spirited Dr. Zubrin that shows the world, using reasonably layman terminology, that Mars is within the reach of mankind in the not-to-distant future using technologies we've had for many years now.

It was important I understood how and if this was possible as part of the experience of using Frontier as this is going to affect either an individual's journey from Earth to Mars or how the whole colony get there within the application.

For my treatment of this theory, see Appendix B1: Reaching Mars: A Simplified Guide.

Research Paper – The Biological Terraforming of Mars: Planetary Ecosynthesis as Ecological Succession on a Global Scale
JAMES M. GRAHAM

By forming my own treatment of this in-depth discussion on the process of terraformation, together with the later chapters of Dr. Zubrin's book, the process in which terraformation would occur in Frontier can be outlined.

My treatment of this theory is detailed in Appendix B2: Terraforming Mars: A Simplified Guide.

B1. Reaching Mars: A simplified guide

Dr Zubrin created a blueprint for reaching Mars called 'Mars Direct' which he explains how man could travel to Mars using technology today for relatively little cost and risk.

NASA have also developed a plan to get to Mars that is somewhat different and unnecessarily costlier argues Zubrin. The two plans are discussed in slightly more detail in the next section.

Mars Direct vs. opposition-class flight plans

Although some of his theories don't seem to take into account backup or abort options Zubrin insists that this is mankind's destiny and there is no gain without sacrifice. Despite such direct plans probably never seeing the light of day within NASA, his plans do seem formed on relatively sensible principles; reduce time spent in space and simplify.

So there are two potential methods of reaching Mars; Zubrin's proposed 'conjunction' and NASA's 'opposition' approach. They are radically different. Their criteria are compared below:

	Conjunction	Opposition
Outbound transit time	180 days	180 days
Inbound transit time	180 days	430 days
Mars stay time	550 days	30 days
Venus flyby needed?	No	Yes
Average mission radiation dose	52 rem	58 rem
Zero gravity exposure	360 days	610 days
Mission cost	Lowest	Highest
Mission risk	Lowest	Highest

Table B1a Comparing the two methods available for reaching Mars

The obvious difference is the time spent away from Earth. Using the conjunction method adopted by Mars Direct, a crew would be away from Earth 910 days (approx 2½ years). The opposition approach sees total mission time as low as 640 days (approx 1¾ years). As such NASA would always opt for the plan that was shorter in duration as there's time for things to go wrong.

However, performing a Venus fly-by carries with an unnecessary risk which far outweighs the extra ¾ of a year total mission time that the Mars Direct approach proposes. There is also the question of how much radiation the crew will be subject to.

Radiation levels are high in space, even though the crew are travelling away from the Sun. We are protected on Earth from this harmful radiation by our atmosphere. In space, astronauts are protected by their spacesuits. Radiation will penetrate whatever vessel carries the crew to the red planet so special shielded living areas would need to be provided to enable them to travel without having to wear restrictive, protective clothing for the duration of their mission. Due to the amount of time needed to be in transit on the way back to Earth in the opposition approach, the dose of radiation is relatively higher but both are less than a dangerous dose.

One final thing to consider is the amount of time the crew will be subject to zero gravity during transit. An increased amount will lead to potential health issues such as wasting muscles and a general disorientation. Obviously then, the shorted time spent in transit is highly beneficial to counteract this.

All-in-all, the journey to Mars (and back) will be nothing short of a hellish ordeal and factors such as emotional stress haven't even been taken into account yet. I need to try and portray this experience

in Frontier somehow as a mix of excitement, potential peril and waiting while keeping it entertaining and enjoyable.

What this means for Frontier

Well, firstly, the most important question I needed answering has been. Yes, it is actually possible to get to Mars today let alone the not-to-distant future.

Whilst this didn't really have influence on Frontier's development as it could have existed even if travelling to Mars wasn't possible, but it has made the whole thing a lot more feasible to distribute to school children as the technology side of it can come into play when considering the logistics of their task.

In terms of how this aspect can be used in the actual application, that depends on how I decide to implement (if at all) the in-application representation of the actual journey a player experiences. See part 2 of this document for full details of any inclusion.

B2. Terraforming Mars: A simplified guide

I'll start this chapter with a little Q & A as I would imagine most people either reading this or interested in using Frontier won't have much of a clue to the details surrounding the process of terraforming a planet.

Q. What is terraforming?

A. Terraforming (terraformation) is the process of creating a biosphere on an otherwise uninhabitable planet so that it can support life.

Q. Is it actually possible? It sounds pure fantasy!

A. Mankind has never attempted something on this scale from scratch. However, humans have the intelligence to shape our existing world to meet the needs of our continuing growth and our huge population is testament to this.

There are a number of unknowns (some detailed later when profiling Mars as a candidate), but on paper at least; it does seem possible without the need for massively futuristic technology.

Q. Can any planet be terraformed to support complex life?

A. No. Life depends on a delicate balance of temperature, atmosphere, available water, as well as a planet's global geological makeup.

In our solar system, only Venus and Mars are sensible candidates to be terraformed (if only because they wouldn't take 100's of years to get to), and out of these two, Mars is by far the best option as it is the most like Earth in a surprising number of ways!

Q. Is the process the same for any planet?

A. No. Take Venus and Mars for example. One is a hellish greenhouse with a thick, established atmosphere; the other a freezing wasteland with hardly any atmosphere to speak of... yet both (theoretically) can be terraformed. The initial process for Venus therefore would be to cool it down before addressing introducing life and the initial process for Mars would be to heat it up!

Q. How long would it take to terraform Mars?

A. Due to the amount of unknowns, experts can only speculate and accommodate worst and best-case scenarios.

For example, in the case of Mars and for completing the initial process of heating it up, the biggest unknown is the amount of Oxygen and Carbon Dioxide contained within the regolith (top-surface of a planet). The more the better and if there is somewhere near what experts believe to be present – the whole process could take about 1000 years. Worst-case and we're looking at nearly twice that.

The Process (simplified)

In the following step-by-step guide, based on the model proposed by Dr Robert Zubrin¹ the process of the terraformation of Mars is discussed including why Mars is the best candidate by far.

Why Mars is the best candidate

First thing to consider is why Mars is the ideal planet to attempt such an undertaking. The main topics for consideration are:

- Closeness to earth
- Distance from the Sun
- 24-hour day/night cycle
- Right gases present
- Evidence that water existed on the surface

Firstly, Mars' closeness to Earth may seem like a trivial and obvious consideration but for terraformation to happen we actually have to get there in the first place!

So far, mankind has not travelled further than the Moon and given that we can only reach speeds of about 22,500mph and the next closest planet to Earth (Venus) is over 26 million miles away; it is not hard to understand why.

22,500mph sounds fast, and on the surface of our planet, it is incredibly fast; but distances in space are truly colossal and until such a time where we can travel faster than this current top speed, we are restricted to only exploring planets within our reach.

Even when Mars is at its closest to Earth² it would still take around 6 months travelling at full speed capable by technology we have today. This isn't an inconceivable amount of time to spend floating around while we wait to get to our new world however. Our current crewmembers on the International Space Station spend about 6 months per expedition in space.

Venus, the only other planet suitable for consideration, is roughly half the distance Mars is from Earth (26 million miles as opposed to 49 million miles) so it would only take about 3 months to reach. However, Mars is far more suitable in other, more important areas and it is still well within our reach.

Mars is 142 million miles from the Sun. That's 49 million miles further away than Earth. Despite this, the average temperature on Mars in the summer at the equator can reach about 24°C, warm enough to support life from Earth. However, part of the terraformation process (see Terraformation a little later in this Chapter) is to thicken the existing atmosphere and heat up the planet. This would see temperatures at the same location/time of year rise to about 28-32°C with the rest of the planet becoming more accommodating with warmer average temperatures as well.

As well as the actual temperature, life needs the power of the sun to grow and reproduce and at the distance Mars is away from the Sun, Mars is still close enough to make this happen across an area that is a reasonable distance either side of the equator.

One of the most seemingly insignificant similarities Mars has to Earth is its 24-hour day/night cycle. Actually, it's about 24 hours 39 minutes to be exact. This isn't just important for maintaining human work/rest patterns; it's actually essential to any plant life we introduce from Earth. Plants would fail to thrive on a planet that took long or was too short in its day/night cycle.

Mars is looking good so far as the ideal candidate for terraformation but it gets even better. If we were to attempt to create an atmosphere capable of supporting human life, the right kinds of gases are essential to reproduce the conditions found on Earth. Thankfully, Mars has a great deal of the gases required to produce air for people to breath.

	Nitrogen (N ₂)	Oxygen (O ₂)	Argon (Ar)	Carbon dioxide (CO ₂)
Earth	78.08%	20.95%	0.93%	0.038%
Mars	2.7%	0.3%	1.6%	95.4%

Table B2a Comparison between Earths atmosphere and Mars' prior to terraformation³

Ok, so the amounts are considerably different and today, the atmosphere on Mars is poisonous due to the large amounts of CO₂, but the elements are all there and through the process of terraformation, CO₂ can be transformed into O₂ by planting various mosses, plants and trees in staged well-planned introduction scheme.

This of course would take a long time to affect something as large as a planets atmosphere, but it would eventually happen and when it does, humans and animal life from Earth could be supported on Mars and if the amount of suspected Oxygen exists trapped in the regolith, as the planet is warmed (another process of terraformation for Mars), Oxygen levels would rise quite quickly.

There is one more crucial component required to support any kind of life. Water. Without it, nothing would survive. Thankfully, Mars has an unknown quantity of water stored as ice at the poles and contained within the regolith.

Here is where the biggest unknown lies. If there the amounts are close to what is suspected, there would be enough water to form a small sea once the ice caps had started to melt and the surface water had be reclaimed from the regolith.

If there isn't a great deal of water already present on Mars, then humans would have to intervene again and produce it. The process of creating water would be possible only on a small scale at first while only simple mosses populate the surface, but when the temperature of the planet starts to rise and the amounts of Oxygen increase and we all know that combining Oxygen with Hydrogen produces... water!

Initial Sate

Today, Mars is a cold and hostile place. There is little atmosphere and what is there is extremely poisonous to humans (as the last section discussed).

Mars is a planet of temperature extremes. The average surface temperature on Mars is a frigid -63°C with extremes that range from 24°C to less than -73°C. In comparison, Earth's average surface temperature is about 14.4°C although we do actually have higher and lower extremes of temperature.

The atmosphere of Mars is relatively thin, and the average atmospheric pressure on the surface is around 0.6kPa (6millibars, or 0.087psi), compared to Earth's 101.3kPa. The atmosphere is quite dusty, giving the Martian sky a tawny colour when seen from the surface.

There is no surface water, but there is a great deal of water on Mars. At present it is locked in the regolith and polar ice caps.

Martian dirt does contain soluble minerals, including potassium, magnesium and chloride, which are the requirements for nutrients to support life⁴.

In terms of what the surface has to offer; the southern hemisphere of Mars is quite heavily cratered and resembles the surface of our Moon. It is old and has been relatively unchanged for some time. The northern hemisphere is quite different. It has few craters and these appear far less eroded indicating they are much younger than those of the southern hemisphere. It also shows much geologic activity. The surface has been smoothed by repeated lava flows indicating a great deal of volcanic activity.

All-in-all, not a very nice planet to be on initially but also a planet of potential and once the process of terraformation has begun (see next section for details), the surface will offer explorers and settlers plenty.

Terraformation

Rather than go into an inappropriate amount of detail (and that would be easy to do as there are entire books on the subject), I am going to discuss the main stages and outline then briefly... roughly to the same level that anyone playing Frontier might need to know:

1. Heat up the planet & thicken the atmosphere
2. Introduce simple plant life to appropriate areas of the surface to start oxygenating the atmosphere
3. Accelerate the oxygenation process
4. Introduce more complicated plants to the equator and introduce simple plant life further away
5. Introduce trees

As discussed in the section above, Mars is cold. The first step would be to raise its surface temperature to a point where simple plant life could be introduced. There are 3 main theories to how this could be accomplished:

- Large orbital mirrors that will reflect sunlight and heat the surface
- Greenhouse gas-producing factories to trap solar radiation
- Smashing ammonia-heavy asteroids into the planet to raise the greenhouse gas level

Oddly, what is required on Mars initially to insulate it and thicken its atmosphere is exactly what we're trying to control and reduce here on Earth. The best way to heat an atmosphere is to create a greenhouse effect, and as humans, we know a thing or two about that. All 3 of the above theories have the same common goal... to warm the atmosphere and surface of the Mars it by creating a greenhouse effect.

Out of all 3 methods, the greenhouse gas-producing factories are the most feasible but smashing ammonia-heavy asteroids into the planet would be the most effective. It does have the drawback

however of rendering the planets surface uninhabitable for plants and humans for a hundreds of years.

As for the large orbiting mirrors, they are most planet-friendly but could only heat small locations at a time and would need to be so big; they couldn't be built on Earth, which means getting them there would be another mission.

It could be that a combination of mirrors and greenhouse gas-producing factories could be utilised in parallel to speed up the job with the mirrors focusing on the ice caps to melt the water and release even more CO₂.

Once Mars has a thick, even more poisonous, but warm atmosphere, the first simple plant life can then be introduced to the planets surface.

Plants such as mosses and small ferns would be the most successful as they need little nutrients, can operate with little sunlight, are hardy enough to survive sub-zero temperatures and are extremely efficient at photosynthesis.

It is the process of photosynthesis that is going to start making the atmosphere of Mars suitable to support life because as we all know, photosynthesis' main function is to take in Carbon Dioxide and release Oxygen.

There would need to be quite a blanket of them in order to make any significant headway in changing an atmosphere (that will be almost totally Carbon Dioxide) of an entire planet and it's this stage that will take the longest.

Meanwhile, any human colony settlers can actually aid this process by modifying the greenhouse gas-producing factories to mimic photosynthesis through various chemical reactions and processes.

With the temperature slowly increasing and more and more water becomes available, evaporation and precipitation cycles would start across the planet making it easier for plants to thrive. Wind would also help with pollination.

Over the hundreds of years this process would require, as more and more Oxygen appeared in the atmosphere, more and more complicated plant life, such as grasses and flowering plants can be gradually introduced until a point where the atmosphere and temperature are suitable enough for the first trees to make an appearance on the surface.

With trees in place, the rate at which Carbon Dioxide would be converted to Oxygen will increase dramatically.

Finally, after an uncertain amount of years (although it will definitely be no less than a 1000), the atmosphere may be at a state where humans can walk on the surface without the need for breathing apparatus and a new world would be ready to fully explore.

What this means for Frontier

First off, there is the obvious fact of timescale. For terraformation to be complete, even in best-case scenarios, is going to take about a 1000 years. I am fully aware that the lifespan of an application such as Frontier is quite a bit less than that!

With that in mind I believe the best way to manage this is to speed things up by a combination of ‘skipping’ a ‘few’ years between each stage (see the previous section) and ‘the more the merrier’. Obviously, the more people and resources you throw at something, the quicker you can achieve your goals so the more people actually using Frontier, the quicker the whole user base can achieve their goals and the goals of application itself.

Full details will have been worked out by the time I have written the relevant section in Part 2 of this document.

Something that is worth mentioning here is that I propose to divide the game world (which will represent the entire surface of Mars) into 3 sections (or bands):

- Tropical – a band around the equator (0° latitude) extending 30° latitude north & south
- Temperate – 2 separate bands extending from 30° to 60° latitude north & south respectively
- Polar – 2 separate bands extending from 60° to 90° (the poles) latitude north & south respectively

These areas are a rough division of Mars but will help users to choose the right location for their particular base type introducing an element of strategy brought about by a democratic decision from all users attached to that colony. Obviously tools for making decisions and planning need to be part of the Frontier application and more details will feature in Part 2 of this document.

For now, there are distinct stages of terraformation which will correlate to significant changes in Frontier’s game world evolving. The following table lists the stages again but also discusses how this would affect the users experience and game world found in Frontier:

Terraformation stages	Frontier experience	Frontier game world
Heat up the planet & thicken the atmosphere	<p>Users would be setting up colonies and those colonies that are greenhouse gas-producing factories would need to start actively working to contribute to this process.</p> <p>Users whose colonies are involved with growing and cultivating plants can operate but are limited to growing crops in their greenhouse bio-domes that will support the application as a whole.</p> <p>Users whose colonies are to mine minerals and resources can operate but only for limited amounts of time as they are outside.</p>	<p>Users wouldn’t be able to explore the polar regions and could only be out on the surface exploring for a very limited amount of time in their heated spacesuits.</p> <p>Aside from interesting geological features found on the surface of the game world, most locations would look the same.</p>
Introduce simple plant life to appropriate areas of the surface to start oxygenating the atmosphere and Accelerate the oxygenation process	<p>Colonies who were once greenhouse gas-producing factories would need to change into artificial photosynthesis factories.</p> <p>Colonies that are involved with growing and cultivating plants can start planting mosses and ferns outside as well as continuing to grow crops in bio-domes.</p> <p>Colonies that are involved with mining minerals and resources can operate for longer periods and be the forefront of exploration of the slightly less hostile world.</p>	<p>Slight changes since the completion of the first stage and now the planets average temperature is higher, users can spend longer exploring outside.</p> <p>There may now be pools of water on the surface in the tropical regions.</p> <p>Unpredictable weather systems start to form.</p>

<p>Introduce more complicated plants to the equator and introduce simple plant life further away</p> <p>and</p> <p>Introduce trees</p>	<p>Colonies who were once artificial photosynthesis factories would start to develop electricity-producing capabilities.</p> <p>Colonies that are involved with growing and cultivating plants can start planting everything outside and the bio-domes become storage facilities.</p> <p>Colonies that are involved with mining minerals and resources can fully operate as a dual-purpose outfit to mine and mass-ship resources back to Earth and supply the factories with fuels (non fossil).</p>	<p>Planets average temperature is high enough for users to explore all but the polar regions of the game world without heated spacesuits.</p> <p>Lots of visible changes as the predominately red surface starts to turn brown and green with large lakes and small seas starting to form.</p> <p>Weather systems are consistent ant and inline with what's expected for the season.</p> <p>Atmosphere still a little too poisonous so breathing apparatus still needs to be worn.</p>
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Table B2b Correlation between terraformation stages and how it would affect and be represented in Frontier

Once the final stage has been realised, Frontier would then require updating to Phase 2 (a proposed sequel dealing with colonisation and the establishments of countries, continents etc.).

There is still the question of timescale but, as mentioned, this will be fully worked out with best, worst and expected-case scenarios of user counts/contributions.

Hopefully by providing all the scope outlined in the table above, I could create a dynamic and changing world for users to explore where the rewards are seeing their contributions actually changing something as large as a planet's atmosphere and ecosystem.

¹As mentioned in his book 'The Case for Mars' – see Appendix A: Bibliography for details.

²Mars' orbit does not change but the time it takes to do a revolution of the sun is not inline with Earth so therefore there are windows when Mars is closer to Earth.

³Each atmosphere does contain trace amounts of other gases too but these are ignored for the sake of clarity and not required for the simple comparison.

⁴Based on soil experiments conducted by NASA's Phoenix Mars Lander in June 2008.

C. Frontier in the National Curriculum

As previously mentioned in Chapter 2: Goals, I propose that Frontier could fit in with the National Curriculum and actually provide a unique way in which classroom teaching delivery can blend in with the applications underlying functionality and activities.

Of course, as I am only producing a range of prototypes that will be representative of the proposed final application, I will not be able to implement the programme in schools, but as a great deal of Frontiers core functionality is influenced by it's intention to be used as a delivery aid in the relevant areas of the National Curriculum, I will be getting school or school children involved in direction and user testing so detailing how it could all potentially fit together is important.

The details for potential delivery are under the assumption that the final application has been built and are not related to the final application prototypes I aim to finish for this culmination of my MA award.

I call this educational purpose approach 'The Frontier Programme' and the remainder of this chapter deals with its details and proposed methods.

C1. The Frontier Programme

Frontier is a multiuser interactive community building application that has the potential to aid in the delivery with some of the values of Citizenship, as described by the Knowledge & Understanding criteria of the National Curriculum at Key Stages 3 & 4, though a support programme. There are references to Maths and Science that could also be recognised.

Participants will sign up through their teacher and simultaneously take part in the programme with their peers at both home and/or school. Working with local schools, the ideal method of delivery will be ascertained as there two ways this could be achieved.

Firstly: all at home; where a group of pupils express interest in taking part in the programme, or are recommended it in class. The programme could then form part of a group assignment for a PSE lesson for example. The support pack that will ship with the programme will allow users to plan their time at home and ensure they are getting the most out of the programme in terms of their development within the Citizenship criteria of the National Curriculum.

Secondly (recommended): a mixture of at school and home with a different programme emphasis depending on participation location.

At school, Frontier could form part of PSE lessons for a few weeks, allowing groups of pupils to take part in the programme whilst in the same room/building for easy communication and programme execution.

At home, the same environment will be displayed, but the emphasis will shift towards a more recreational experience with the ability to chat, play games and visit other groups' environments, even other environments that pupils from different schools have created! Parents and children alike can rest assured they are safe online outside of school hours as only teachers can sign up pupils at their school.

Pupils will also be able to take a part of their experience with them wherever they go with the ability to download their personal space to their mobile handsets!

C2: The Frontier Application (educational angle & possible delivery methods)

Frontier will take the form of an interactive game with an overall aim to colonise and terraform Mars. Participants will learn the basics of how to achieve this and how their contribution, through working as a team, will help a combined effort to reach a common goal.

Groups of participants will not be alone in their quest to contribute. The playable planet world will house several other schools, each with their own groups, in their own colonies participating simultaneously towards the ultimate goal.

As citizens within their colonies, participants will encounter situations which they will later be able to relate the actions they take as citizens of the UK. Situations and important activities like democratic voting, economies, relationships with other groups will all help develop their skills and understanding of how, as citizens, their input is important.

As school time is a precious commodity, the full benefit of using the application will be achievable relatively quickly, with attainable targets set for only a few hours work. That's not to say the fun, learning and development has to end there! It will be possible for groups to carry on their good work outside of the programme, once their time has expired. This will be off their own backs, and no longer supportable in school. By this time, however, the participants will have a good grounding in how and why the application works.

It's not just Citizenship skills that will benefit from using Frontier. The overall aim of the experience is science-based by its very nature, and along the way; maths skills will come in very handy. There's even scope for the figures generated by each groups contribution, or indeed, that of the school, to be used in statistics classes.

A safe, secure online environment

Using a combination of existing Internet technology and cutting edge multi-user servers, Frontier will work on any computer that has a reliable connection to the internet and Adobe Flash browser plug-in installed.

Frontier will run from a secure internet site ensuring that every connected participant is using the same and latest version of the application.

Only registered participants can log in and use Frontier making it safe for all. At school, teachers will have the ability to log in and monitor communications and behaviour, although precautionary steps such as bad word filters and automatic disconnection for repeat offenders will be included for minimum disruption.

At home, users will benefit from the same secure and safe environment as participants will have to use the same login details to access Frontier, and new users can only be signed up at school.

Application Structure & Delivery

The programme will be split into two distinctly different experiences: the work experience and the recreation experience and this chapter details a possible way of using Frontier in the classroom:

Work Experience

Work experience will allow participants to work together towards a common goal by taking on one of a number of different roles. It is this portion of the application which would best be suited for delivery in a classroom environment.

This particular experience will be split into 2 stages and have time limitations applied to it. This is partly to ensure that the experience is delivered consistently without gaps and also in a bid to keep it as fair as possible and aid in the delivery.

Stage 1

During this introduction stage, participants will watch (around the same computer screen) a presentation identifying what the groups' tasks will be. It will take the participants through the planning stage, give an idea about the kinds of activities they will be expected to complete in the possible roles available to them, give the facts about the mission, the different colony/base types and the Planet, and advise how to approach the overall task.

Participants will then log into the application for the first time. Their username will be their full name, and their passwords will be provided by the teacher. Once they have entered this information, they will be prompted to change their password and enter a name by which they want to be referred inside the application. Offensive names will not be allowed and can be changed at any time by the teacher if they are found to cause offence.

From the logged-in welcome screen, each user will choose their visual appearance (this can be modified at a later time). There will be a count-down timer that is shared group-wide and will start when the first participant logs-in. The group will have 30 minutes to get from the welcome screen to the end of stage 1, and each stage from here on will have a clear time limit displayed and enforced.

Once the groups' character aesthetics have been decided, each participant will then be presented with a screen that has each of the group members' names on. This is the 'vote for a leader' exercise, and the group must use their knowledge of their group members to decide who should lead the team. Team leaders will have the power to settle disputes and speak for the group when an application-based decision is required.

Next, the users will appear together in a room with different icons representing the different colonies/bases available and the jobs that are required to run that particular settlement. Each user walks to the tile that represents which job role they want to take. Only the leader has the ability to confirm the selection, and that can only happen once all required roles are taken. As the group sizes

may vary, it is possible that more than a single participant can do the same job. This will not be too great an advantage over a group with the minimum number of required members, as the larger the group, the higher the amount of expected output (which will be explained in more detail in the Frontier Programme support pack).

After all the role assignment has been completed, the group must use their remaining time to collect stock from the warehouse to load up their ship. There will be a number of different stock items available to take, but not every item is required. This exercise will be a test of how well the group communicate and how much they have paid attention to the introductory presentation. If there are any disputes, only the team leader can remove items from the ship.

The final stage is the journey itself which doesn't actually require the group members to do anything. The journey will start when either: all group members are aboard and the team leader has accepted the supplies, or, when the timer reaches 0. At that point, all group members will board the ship (under control of the application) and any additional stock spaces will be filled with the most useful (again, by the application).

Whilst on the journey (which will take about 10 minutes), the group can gather around the team leaders screen and they can all plan the layout of their settlement.

Each group will either choose or be assigned a plot of land to build their settlement. The settlement will be awaiting them on their arrival to Mars, but there is scope for development of the plot on a personal and group level later on.

Eventually they get to Mars and have the remainder of the lesson to explore their new settlement and settle into their personal accommodation space!

Stage 2

Any time from this point onwards spent in class working with Frontier will actually be the day-to-day base/colony maintenance and contribution towards changing Mars' atmosphere. This is of course is dependant on the type of base they chosen during Stage 1 of the programme.

Full details of the kinds of tasks each role/base combination entails will be featured in the Frontier Programme support pack.

These sessions can run for a few weeks, as there are planned scenarios that can be triggered by the teacher at the start of a session in the classroom that will help deliver aspects of Citizenship.

Details of these will follow as the project develops and all details will be featured in the Frontier Programme support pack

Recreational Experience

At home, or at school outside of the participants allocated time spent with Frontier in the classroom, the application will still be accessible using login details provided/amended in stage 1. However, the participant will not be able to work as he/she would if they were playing it inside of their allocated classroom time.

Instead, users to get to do ‘fun’ things such as:

- Explore the surface of Mars including areas of interest.
- Make alternations and change their rooms’ appearance using both PC and mobile device versions of the application prototypes.
- Visit other colonies/bases set up by other classes in their school and potentially schools across the UK to chat to users attached to that colony and see the work going on there.

If the desire takes them, a user (or users) can continue the work undertaken by their colony to contribute towards the application-wide goal of altering the atmosphere of Mars.

At this point there is an unknown as to what is going to happen to the Frontier application once the atmosphere of Mars has been changed sufficiently for terraformation to be considered complete. Whatever the decided outcome, The Frontier Programme will continue to feature aspects that can be used as classroom aids in the delivery of certain areas of the National Curriculum.