



Orbiter View

Interview with wehaveaproblem, December 2013.

Hello everyone, and welcome back to Orbiter View! I'm John Lawson, BruceJohnJennerLawso on the Orbiter Forums, but please call me Bruce. Like most of you reading this, I am an avid fan of the Spaceflight simulation program Orbiter, a free, physics based simulation of spaceflight in our Solar System and beyond. I am here today with wehaveaproblem, another well-known developer in the Orbiter community, best known for creating Wideawake International, arguably the most famous surface base ever made for Orbiter.

BruceJohnJennerLawso: So, tell us a little bit about how you found Orbiter. Apparently you were part of the great M6 migration, so I would imagine you've been part of the Orbiter community for quite a while now?

wehaveaproblem: Yeah, I guess I'm an old-timer, although I'm no Urwumpe or Garyw! I honestly don't remember exactly when or how I found Orbiter. I suspect it was during an internet search for alternatives to that Microsoft Shuttle Sim from way back. I do remember printing out the manual on my parent's printer (a lot of ink!), so it must have been sometime around the turn of the century... And yes I was part of the M6 migration, but I remember very little about the old forum, only that it wasn't as good as O-F. Not to belittle the folks who ran M6, but the admin/mod team for O-F have done, and continue to do, a sterling job. I'm sure it's one of the reasons I still have Orbiter in my life, despite hardly ever actually playing the game. I just enjoy the community and the creativity that is shared here, using Orbiter as a medium. It wasn't until the O-F community that I started modding and really getting involved, I don't think that is a coincidence! I have always come and gone to Orbiter over the years, and it's reassuring to see the stability of O-F community and the same old guard holding the fort (plus some new faces of course, Bruce).

BJJL: That's good to hear. If you're comfortable sharing it with our readers, would you mind telling us a bit about what you do in real life?

WHAP: At the moment I'm in a bit of a transition workwise. I'm a bit of a jack-of-all-trades, having tried various day jobs during my 20's, none of which were particularly interesting or noteworthy (apart from being a secondary school Drama teacher perhaps). So I decided go back to university when I was 30 to study for a BA in War Studies at Kings College London. I completed that degree this year so am now trying to find a job in a military history sector, such as in a museum or similar. But it is a very competitive field here in the UK, so wish me luck!

My spare time is split between various hobbies and creative projects. I develop for Orbiter obviously ("Not so obviously lately, whap!" I hear you cry). I dabble with GameMaker, coding many half-games and I'm writing a sci-fi novel. I'm also a tabletop wargamer, and my main creative focus at the moment is designing a range of model buildings and a WWII card game. Both of which I hope to release commercially next year if development and testing continue to go well.

BJJL: That sounds quite interesting; I certainly wouldn't mind getting a chance to read that novel once it's completed. I was also hoping to ask, what sort of changes have you seen in the Orbiter community over the time you've been here? I've only been here a year and a bit I think, but I think it's obvious that the story of Orbiter has a rich background thanks to all of the people involved.

WHAP: What sort of changes to the community? That's an interesting question.

First and foremost I think the proliferation of add-on developers stands out for me. Remember that there was time when your flight options were the Shuttle or the vanilla DG and that was about it. But now Orbinauts are spoilt for choice, with the excellent DG and XR variants, real world and fictional rockets, modules and payloads aplenty, even the odd fancy base... and all for free! Orbiter-Forums has really provided the perfect forum (literally) for people to share ideas, develop concepts and work together to enrich our Orbiter experience, surpassing what I suspect Dr. Schweiger ever expected.

And on a more holistic level the community has simply grown and matured I think. It is, for the vast majority of time, a pleasant and supportive place to be, somewhat like a family. It has nice people willing to give their time to others, offers support and encouragement and, like all good families, it has a few blunt and grumpy uncles that occasionally ruin the party! It encourages education and an interest in science and maths, it promotes debate and it challenges minds. And I hope, in that respect, it fulfils what Dr. Schweiger wanted from his simulator. I'm rather layman when it comes to science, the true reality of Delta V is lost on me, but I have learnt a lot here and have passed some of that knowledge on to others even less knowledgeable. I'm maybe sounding a little romantic, but I think life-long learning is important, and places like O-F promote that in its own way.

BJJL: Can't agree more about life-long learning. I think that sort of sums up why many people enjoy having discussions here; it's a chance to learn something new every day.

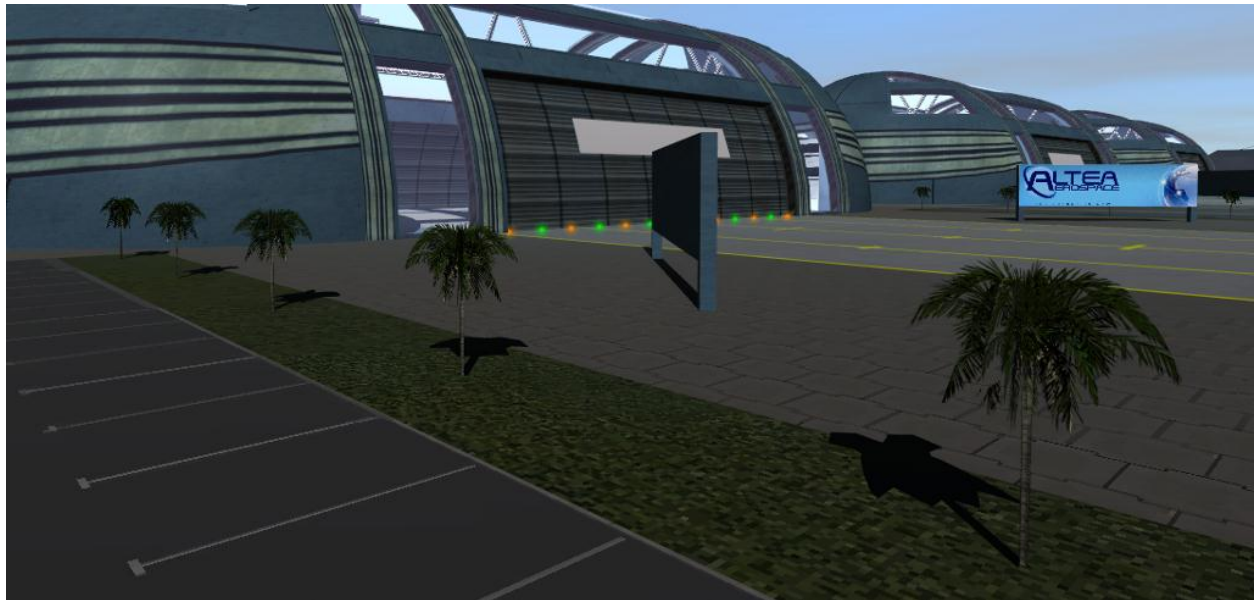
So getting to the very big topic here, could you tell us a bit about Wideawake International? For starters, why Wideawake, and not just "Ascension Island"?

WHAP: Originally it all grew from a desire to create a fictional British space agency, which I intended to do as a 'realistic' space program, starting small and taking baby steps towards returning to the moon. I think my first iteration was called the UKSSP or something. I wanted a unique launch facility/base for this, but it quickly dawned on me that any space program launching from the UK would have serious limitations placed on its launch capabilities, due to how far north it was. So I started looking at what remained of the British Empire to identify a possible overseas territory to use instead.

I found Ascension Island and Diego Garcia, which were both much better suited geographically than the rainy UK and had existing airports. Of the two, I chose Ascension purely because the aerial/satellite pictures I could get of it were much better, and the simple shape made it much easier for a first time developer. Plus, it has a little space heritage with a NASA tracking station and I believe it was on one of the launch abort site lists used by the shuttle. And of course, how perfect is the name 'Ascension' for somewhere you take off from to go to the stars!? Wideawake itself is the real world name of the RAF/USAF airfield that operates on Ascension, and I just love that name, it sounds fictional, but isn't.

So anyway, I developed the very first version of the island, with little more than the RL airfield present and intended it to stay that way. But the add-on proved popular, so I decided to bring it up to the modern era and develop the space base part of it further. This also coincided with the development of the XR5 and led to some fundamental changes in my fictional agency. I basically 'sophisticated it up' a bit and pushed it into the 'near future' tech of the XR vessels. Re-imagining it as an international private space enterprise that would use the XR fleet... and lo, Ascension International Aerospace and the Ascension Project was born.

WHAP: Wideawake was redeveloped and expanded, with multiple, longer runways, plenty of hangars and vertical launch facilities... and of course the infamous 'runway' that is 'blocked' by a VAB! I had intended to stop developing there and actually crack on with AIA stuff that could use the base. For those that have followed my development work, Project Toehold Space Station and Lunar crater base, the HODP, the BDB, the touchscreen cockpit, the collapsible dry dock, and some others will ring bells for projects that I started but never finished... why? Well mostly because I was never truly happy with Ascension as it was and that bugged me. So I decided to totally re-do the whole thing from the ground up. Face got involved and this opened up a world of new possibility (and hard work!)... So the development of Wideawake International: Ascension Ultra Edition began.



BJJL: Silly question: Have you ever had the chance to visit Ascension Island?

Were you surprised at the reception Wideawake has had? It really is amazing how it has entrenched itself as a part of "Orbiter culture", no install ever really complete without it.

WHAP: Ha! Unfortunately I haven't had the chance to go to the real Ascension, although I would like to. It's funny though because I feel like I know it and have some affinity with it now. It came up in a university lecture about the Falklands War and all I could think about was AIA and Orbiter. Luckily I kept my mouth shut despite my initial reaction that somehow I knew more about the place than the other students!

Was I surprised by the popularity of the add-on in the Orbiter community? Absolutely, I still am! After all, it's a base in a space flight simulator, so people spend about 1% of their simulation time there. But with over 19,000 downloads to date, it clearly is popular. If you will indulge me I'll say why I think that is.

First, well it was first! By that I mean it was the first functioning island base add-on (I think). It has competition now, Overton for example is a really well made add-on, but it still seems WIN is more popular. Being the 'original' gives Ascension a certain prestige and, like you say, it has become part of 'Orbiter culture'.

Second, without sounding immodest, it is a well-designed and well-made add-on. I took great care in making it as efficient and clean as possible, especially regarding the poly count. It has a good balance between detail and graphics/cpu demand. That wasn't an accident, and I think therefore it is usable by all Orbinauts, without fps loss or slow down, making it a nice alternative to KSC or wherever.

Third, it's a tropical island in the middle of the ocean and who doesn't like that! But I think that adds a couple of extra attractive features for users. It's naturally pretty, and has some simple topography, so is a nice place to approach or a cool place to fly from. Also, the fact it is an island helps your immersion. With some continental bases, there is a clear divide between the planet's textures and those of the base's tiles. Even with fading, it can jar your brain a little bit and remind you that this is a flight sim. I know you always know it's a simulator, but it's that kind of continuity of experience that makes flight sims like FSX so appealing, and can break your immersion when it's not there. I think, in some small way, because it is just surrounded by blue sea, Ascension feels less 'added on' to the base game... maybe it's just me.

Forth, the location of WIN shouldn't go unmentioned. At 7 degrees from the equator it is great for launching to a variety of orbits, and is also easier to get to on re-entry than some bases. Again I think this adds another bonus for Orbinauts using it as a home base or as a destination.

Finally, landing on an island just feels harder and cooler than landing on a continent. The irony is that the runways are bigger at Wideawake than at KSC, so technically it's easier to land there, but somehow it feels more challenging and exciting. Hitting that speck emerging from a blue horizon is, I think, cool stuff, and I think Orbinauts like it too.

I want to quickly thank all the users and advocates of WIN, I'm glad people find some pleasure in my work. And without them I would never be motivated enough to keep developing for Orbiter, albeit very slowly!

BJJL: Could you describe the development of Wideawake in more detail? It's fairly obvious that you have great skill in modeling, how did you develop those skills over time?

WHAP: So, a little more on the actual development of Ascension.

Your compliments about my modelling skill are very kind. The fact is that all the WIN models are very simple architecturally and texturally, so the skill wasn't really in the making of them, but in the design. I have learnt a lot about 3d modelling through my dev, but the technicalities are not really that hard, not at this level anyway. I honestly believe that any Orbinaut could have modelled Ascension, but perhaps not everyone could have designed those models. Getting the balance right between minimalist architecture (thus low poly) and yet maintaining some sense of independent cool style was quite hard to do. Simplicity is always complex! But I think I got the balance about right and as a consequence is more appealing to a wider range of tastes.

All that said, I have put tons of hours into modelling and have certainly improved. It's an interesting question you ask about how I developed those skills. The reality is Ascension was my first real modelling project, so I was learning it all. I think deciding to start simple was the key to achieving the level of skill I have. Starting with a simple island base allowed me to learn about surface tiles, basic texturing, simple models etc. I tried to match my expectations and goals to my current skill level, building on what I learnt step by step. If I had tried to make the Ascension I'm making now, back then, I would have failed or made a messy add-on for sure.

When it came to modelling, choosing simple architecture made learning easier. As I said earlier, I worked hard to keep the models clean and low poly, and that simply came with practice, but it was easier because of what I was trying to model. I was also motivated by something that bugged me: lazy modelling. When I was learning I would download other add-ons and random models from the internet, and import them to AC3D simply to see how they had been made. I was astounded by how wasteful many of them were. Lazy modelling doesn't mean ugly modelling necessarily, I saw some great looking models for sure, but they used far, far more vertices and polys than needed. There was one launch tower for example, it looked great, but it had 130,000 polys! For one launch tower! The whole of WIN has way less than that. So that pushed me to be as efficient and clean as I could be.

Texturing was a whole other learning curve, although I had more previous experience with art and graphic design. I use GIMP for all that stuff, purely because it does what I need and it's free. I realised quickly that I don't have the artistic talent to draw my own textures from scratch, but I am quite good at post producing other's work. So I use textures I find on the internet (all free), then I combine them, edit them, draw onto them etc. An important thing to decide, for any graphic design project, is the colour palette. This guarantees a sense of continuity and 'feel' to the whole project and helps bind it together. I chose blue as my key AIA colour, because I like blue and I find it an easy colour to manipulate. Pairing it with grey is a safe colour combo, and also reflects the slightly industrial nature of the whole place. And of course, it keeps it simple and inoffensive to the senses.

A final thought on meshing. I use AC3D for all my modelling and UV mapping work. It is a great program in my opinion, with all the tools you need for beginner to intermediate modelling. I tried some other programs, including Maya, and although some are far more powerful and capable than AC3D, they are also more complex and harder to learn. My work pace is sporadic, so it helps to have a simple program I can remember how to use after a long break. Plus it's very cheap compared to other modelling software.

BJJL: Could you describe a bit more about how you keep your models performance-friendly? I think a lot of developers would like to learn a bit more about how you avoid poly-excess, as it really can go a long way towards improving the Orbiter experience for users.

WHAP: Performance friendly is obviously a slightly ambiguous term, as people have different PC specs. But there are a number of things I try to do to make them as efficient as possible, regardless of how detailed the model actually is. I suppose I have two maxims I try to work by: "Can I see it?" and "Do I need it?". They are often related, but let me try to explain. As you know, models are made of vertices which combine to form surfaces. My aim is to always try and use the minimum amount of both to create my models. This may sound obvious, but like I said earlier, it is often not the case for many models out there. So, "can I see it?" is a good place to start. Basically, I literally ask myself that question for any vertex or surface I add to the model. If it can't be seen then it is probably superfluous.

A simple example is the bottom of models. Take a look at WIN and you will notice that the models do not have undersides. You should technically never be looking at the models from underground (even if it is possible to do so in Orbiter), so there is no point in having surfaces there. If you can save even 20 surfaces in this way on each model, that soon adds up. Likewise if you make models by combining several geometric shapes together, you will often find redundant surfaces lying between them, where they join. For example, If you align and connect two identical cubes together, you are already wasting 4 triangles (2 for each touching side of each cube). So after welding the vertices together, you should also delete those surfaces. Similarly, if I have a small cube intersecting a large cube, it is likely that one of the 6 sides of the small cube will be inside the large cube, so delete it!

On that note, welding vertices which share the same point in 3D space is vital. Not only does this reduce the vertex count, but it also aligns the surface normals at the point at which those surfaces meet. I won't go into normals here, but suffice to say joining surfaces in this way is important for textures and to avoid possible graphical anomalies.

These are simple examples but hopefully they illustrate the principles of how I work. The more complex a model becomes, the more important these things become.

So "do I need it?" is fairly easy to answer when it comes to things you can't see, removing those is a no-brainer. But deciding if you truly NEED a vertex or surface is more complex and comes with practice. Basically, efficiency is key here. If, let's say, I know I am going to use a single texture image for a square hangar wall, there is no need to have more than one surface (actually 2 triangles in this case but you get the point). I only break that wall up into multiple surfaces when I know I intend to repeat or use different textures on each of those surfaces.

Textures come into play in another, perhaps more important, way though; that of detail. I work out what detail can be shown in the texture, and what detail has to be modelled in 3D. For example, there are no door handles on Ascension, because that level of detail is simply not required in this instance. Take a look at someone like PennyBlack's skins (I admire his work greatly). They make things like the XR look more detailed, but the mesh is the same, so it's a good way to explore how textures can save you polys. That said, larger, more detailed textures obviously have a greater memory demand, so there is a balance to be had. But in my experience, as a general rule, less polys always trumps smaller textures in regards to memory savings. And of course, you can always produce a range of resolutions for your textures to help this. It is much easier and quicker to scale textures than it is to create multiple versions of your model.

BJL: Thanks for those great points on 3d design.

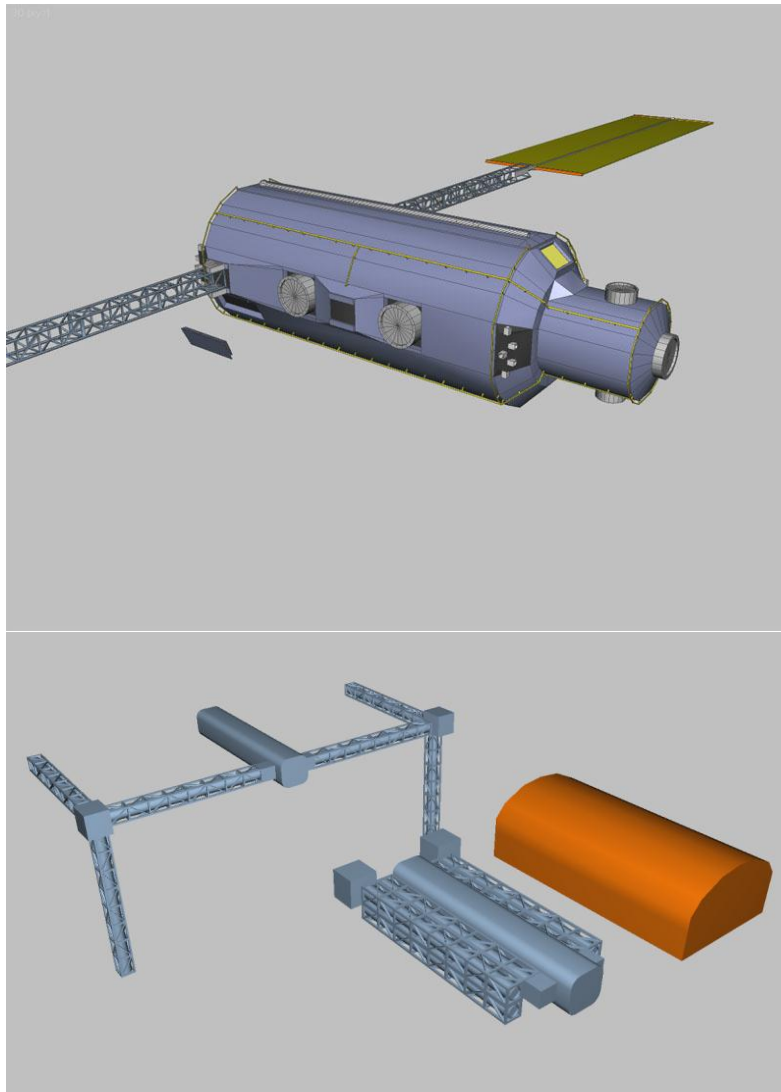
Taking a bit of a detour for a minute, could you tell us a bit more about your other projects? I've seen one or two of them on the forums, but I get the sense you have several others that you are working on as well?

WHAP: So, other projects... (I assume you mean Orbiter projects only).

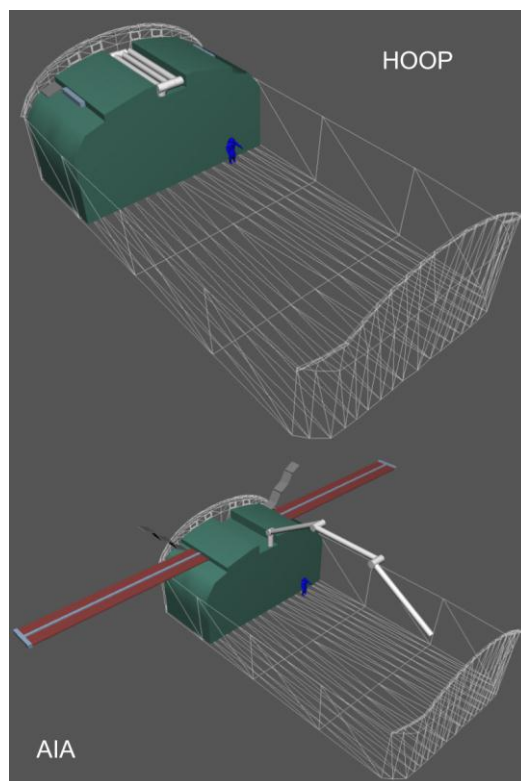
Well obviously my main effort is Ascension Ultra. I won't go into that too much unless you particularly want me to, as there is a lot of info in the development and beta threads, as well as on my blog (<http://wehaveaproblem.wordpress.com>). But basically it is a much more complex project than the current WIN. I honestly believe it does a lot of things never before seen in an Orbiter base. Face has really opened up a whole new world of possibility with his coding and, when it is done, I think it will be technological match for the XR fleet. That is to say, I think it will feel as involved and detailed to use as those ships are to fly.

Anyway, other projects. I think I mentioned the Toehold Project in an earlier answer. Second to the Ascension Project, this is the oldest concept I have. It was supposed to be the next stage of AIA in their space endeavours, but it has taken second place to the Ascension Project now, although I do hope to return to it someday. Originally it was supposed to be a space station in Earth LEO, supporting the follow-up Foothold Project, which was going to be a lunar base built into a crater. But then I decided we had enough space stations and we needed more bases, so Toehold essentially became Foothold and the lunar base. But then I decided to remake Ascension so it got bumped back... I haven't done any lunar base stuff, but I have actually done some space station module work. The whole idea was that all the modules could fit inside the XR5 bay, the AIA heavy lifter of choice. Some of my latest concepts are in a thread on OF, although the concept is much older.

Some pictures from various designs as of 2009 and 2013:



WHAP: Linked to the original Toehold concept and the XR5, was the HOOP and its variants. This "Habitat for Orbital Operations and Payload" is essentially a payload module that provides accommodation, engineering/science labs, solar panels and a manipulator arm, enabling prolonged orbital missions for the XR5. I had planned to release a range of variants for different functions, and the idea proved popular, but I never saw it through. But again, maybe one day I will come back to it.



A personal favourite phantom development of mine is the fairly recent orbital dry dock. It's an idea I had for years and finally got round to playing with one afternoon. There are two requirements for the design: It must fit in the XR5 bay for launch and deployment, and must be big enough to accommodate the XR/DG class vessels when deployed. It's basically an exploration into architectural origami! And I'm pretty damn happy with the result. I just have to finish the bloody thing!

There is a video of it animating here: <http://www.youtube.com/watch?v=FKKKB1w4adY>.

I've dabbled with other stuff, but I think that is the meat of my work. There are development threads for most of my projects on O-F and more info and images on my blog. One thing to come of the current Ascension development is that I really don't want to create *another* base after this one! So the fans of my other non-base projects are more likely to see them come to light.

BJL: So, what sort of features will the new Wideawake International have once completed?

WHAP: Ok, so Wideawake International Ascension Ultra 2010 Edition (full name, AU for short!)...

There are essentially 2 aspects to AU, the meshwork and the coding work. As I have already said, the original WIN was about minimalism and cosmetic functionality. I kept poly counts as low as possible, the style minimal and all the functionality was just visual. The hangars and so forth didn't DO anything, other than looking like the thing. AU is very different in both respects. Not only are there many more, higher poly and more detailed meshes, but they actually do things because of the code. The key difference with the back end is that the base is now loaded as a vessel with its own code module and MFD; this means face can add whatever functionality we want (within reason!). AU is designed to not only feel and look like a base, but actually be interactive and offer things not yet offered in standard orbiter bases. I have spent a lot of time designing and 'building' the base to try and create something that is believable yet a bit sci-fi, that is sexy yet practical. But face has allowed me to take that to the next level and I can't thank him enough for that. All the functional elements of the base are controlled through the MFD in such a way as to help create the illusion that you are actually there, as a pilot in a vessel.

So, rather than rattle of a list of stuff, let me give you a little storyboard type example which will illustrate some of the functionality we are implementing and have been working on most recently.

(I got the AIA PR department to knock this out for me, so excuse the dramatic prose) 😊

You are in one of the cavernous Turn-Around hangars in an XR2 with sunlight streaming through the blue glass roof. You have just used the cargo crane to load your payload and now you want to launch. You make contact with Ground Traffic Control and request a Roll-out; this triggers the hangar door to open and the vista of the Wideawake to come into view. Because you are new to AU and don't want to get lost, you request guidance to the Launch Facility. This triggers strobing beacons on the taxiways which guide you to your destination, past the stylish glass and steel architecture, the manicured lawns, palm trees and shiny advertising billboards. When you reach the facility you contact GTC again and request entry. Ground then guides you through the facility, one stage at a time, from pre-flight checks to passenger loading, fueling and finally into the 4km Launch way... You have checked your bird over, loaded up the passengers and filled her with gas, the blast shield has closed behind you and the sound suppression system is active... you are ready to blast to the heavens! Now handed off to Air Traffic Control, you are given clearance to launch. The flashing red Hold lights turn green and you open up the throttle... after the heart-thumping ride down the Launch way you pitch up and begin climbing. Looking over your shoulder you see the smooth and detailed topography of the beautiful Ascension Island, you notice the radar station tracking your ascent... and in a few blazing seconds the ATC signs off and wishes you a safe journey...

There are other cool things in AU too and my story belies the complexity going on under the hood, but you get the idea and can read the threads if you want more details. I will add that we are currently implementing radio chatter to try and bind the whole thing together a bit, which uses on-screen text and the windows voice synth to imitate a 'real world' radio conversation between pilot and tower; somewhat like SFX or similar. We also plan to implement LoD and an options menu, so that people can control just how detailed their experience is. Although there is less concession to weaker computers, this should help people scale the graphical demand and also tailor the experience to their tastes.

WHAP: The main development thread for Ascension Ultra can be found here: <http://orbiter-forum.com/showthread.php?t=20422>, and the Beta test thread here: <http://orbiter-forum.com/showthread.php?t=28106>.

BJJL: On a less serious tone, what do you like to do with Orbiter? I understand you don't have a ton of free time for it right now, but what do you do when you can find some time?

WHAP: So, me and Orbiter eh?

Well I honestly haven't played it in ages. Am I allowed to use the world play? *ahem* I haven't simulated a space flight in ages. But when I did/do I favour the XR fleet (surprise!), especially the XR5. So I've racked up plenty of ascents and payload deliveries in her. I like docking, but do struggle with my orbital alignments. But that moment when your target can be eye-balled for the first time and the distance starts to close, my heart always starts to race at that moment... as that speck looms out from the black, getting bigger and bigger as the world races past below. I do like that, even if more often than not my target starts to recede and become a speck again



I like the idea of station building too, as some of my development work reveals, and have constructed a couple of structures. But it always leads me to start designing modules rather than flying them. Obviously, I like re-entry and final approach to Ascension too, but again, my skills do fail me often. I think there are more wrecks in the South Atlantic than there are tyre marks on my Ascension runway!

Beyond earth, I've never actually been beyond the moon (without the editor). Partially because TransX hurts my brain, but also because I like our little grey rock, I think she's pretty, and it's an easyish transfer and a shorter journey time too.

Oh, one last thing... racing (ORL)! Although I did a fair bit of single player racing (being the add-on developer), I only did MP racing once, but it was genuinely awesome. I always thought it was a shame that never took off more, but I just don't have the time or hard-core enthusiasm to organise it myself. That's something I would do again though.

BJJL: I have also heard interesting things about ORL, and the lovely sea-life ecosystems built out of the XR2 wrecks all around Ascension Island. 😊What do you like the most about using Orbiter Multiplayer? Do you think that it really has a strong future with the Orbiter community, or is it just a passing interest for most Orbinauts?

WHAP: Orbiter Multiplayer is an interesting fork in Orbiter development. So many games have multiplayer capability nowadays that it seems natural Orbiter should have one too. But as we all know the time syncing issues with a simulator that requires huge amounts of "dead time", resulting in the need and use of time acceleration, make it hard to implement for the majority of Orbiter activity. Rocket Racing is a bit different. There is no time acceleration, and the scale and the time frame of a race is minimal. This means that MP is doable, but also that it becomes essentially just flight simulator racing. Therefore, Rocket Racing is only ever going to be a niche market within the Orbiter community I think, after all this is a space flight sim! That said it's a really fun one, and I encourage people to try it out. The more people that support the MP movement in any form, the more likely it is that workable solutions will be developed for broader uses of MP. But I think in reality, MP is likely to be most feasible in a 'coop' way, rather than a truly multiplayer way, where a small number of players can share a simulation, and hence coordinate time accelerations without hindering activity. Trying to make an Orbiter MMO is always going to be a technical and practical challenge probably not suited to a realistic space flight simulator...

BJJL: On a tangent somewhat similar to that, what do you see in the future for Orbiter? The last few years have been very interesting, with UMMU, UCGO, D3D9, AMSO, and many other amazing tools becoming available to the Orbiter community. There are also a lot of exciting works in progress like the Orbiter Battle Simulation Project, Interplanetary Modular Spacecraft, the G42 Starliner, new XR vessels, the FOI projects... It's really amazing!

WHAP: The future of Orbiter... What genuinely impresses me is that Orbiter is already, hands-down, the best space flight simulator available, and it's free! With the continued advances in development, the visuals are no longer essentially secondary to the physics. It is now rivalling the quality of commercial AAA titles... and it's free! Now I'm not suggesting for a minute it goes commercial, and I doubt Dr. Schweiger would ever want that either. But it is interesting to think that such an awesome program (with add-ons) is better than many games that make money... and this one is free! So in that vein I expect Orbiter to carry on developing the way it is, basically getting better and better visually, and more and more involved simulation-wise. Although rooted in 'realistic' simulation, the Orbiter community is quite broad in its interests which I think gives it more longevity. There are those that like historical, those that like the near-future, and those that like warp-drives and photon cannons... As long as Orbiter (and the community) doesn't lose its educating ethos and remains primarily focused on realistic technology, I think Orbiter will keep teaching and entertaining people for decades to come!

BJJL: That's really great stuff WHAP. I think that just about covers everything I wanted to ask...

no wait, there was one that I forgot to bring up last time around. Can you comment on where you think the future of human exploration of space is going? We live in very interesting times with some of the first launches of the Falcon 9 & Antares launchers, and many interesting plans for future missions being thrown about, but it is very expensive, and sometimes the future can look somewhat bleak.

WHAP: Oh a real world question!

Fundamentally I think private enterprise will form the majority of space activity in this century. Governments can only invest in space exploration now if tax payers are willing to back it. The Cold War space race was politically and culturally motivated. That time is long gone, and with it has gone the will, the reason and the funding for such massive, focused space projects. However, the private sector is now stepping up to exploit the market gap, because yes, space is a possibly lucrative market. Money, as is often the case, is the motivation now. That's not to say we have lost our spirit of endeavour or desire to explore, quite the contrary, it just means that some people have to get rich in return for funding. And I don't have a problem with that.

Capitalism offers us the ability to benefit from those who want to make money, as they will offer the products and services that sell, that the consumer wants. As more money is pumped in and the market grows, things will become cheaper due to economies of scale and technological development, therefore opening the market to more consumers and further market growth. Although, at present, the main move seems to be for space tourism, I think this will expand to other markets as the technology permits, such as science or resources. Gradually, the cost/benefit analysis will come up in favour of farming our solar system for important resources (particularly fuels). And I think we are close to that time, I suspect we will see it happen in my lifetime (I'm in my 30's).

In turn, this frees up governments to spend on educational science, manned flight or resource farming. Using technology developed and produced by the private sector allows them to focus funding on specific mission components instead of the whole shebang, hopefully making major steps, like extra-terrestrial bases, a possibility again.

WHAP: The only real thing that could cause problems (ignoring global collapse or apocalyptic disaster) is security. As space becomes valuable, people will want their assets protected, so we can expect some interesting/challenging developments in law and the methods we use to enforce them.

I could go into more detail, but that's my thoughts/hopes for the future in a nutshell.

BJJL: Thank-you. I think that pretty much covers everything. Unless you have any more ideas for further questions, I would like to thank you for your time. It's been a real pleasure getting to talk to such a friendly person, and I hope to see you round the forums every now & then 😊.

WHAP: Well if you have no more questions, I have no more answers. The interview has been a pleasure; I hope someone finds it interesting or useful. It's a nice initiative you are working on with Orbiterview, kudos!

BJJL: Thanks, and have a merry Christmas.

