JUMP POINT

A Roberts Space Industries Publication   Issue 01.03

GREETINGS, CITIZENS!

This month's featured craft is the Hornet Light Fighter, from both exterior and interior perspectives. We've also got the graphic development of the UEE Naval Pilot.

Meanwhile, another new issue, another new feature — we're adding a monthly Portfolio, this time highlighting Anvil Aerospace, the manufacturer of the Hornet, Gladiator and other top-of-the-line craft. We've also got a behind-the-scenes interview with new Chief Technical Officer Jason Spangler, the second part of Dave Haddock's *Last Flight of the Seraphim*, and a Merchant's Galactic Guide article on Cathcart system and the notorious Spider.

Actually, we're adding two new features — I've got an email address that you can use to send me questions, suggestions or even critiques regarding **JUMP POINT** (friendly, I hope …):

David.Ladyman@cloudimperiumgames.com

To answer one question I've seen: yes, that really is my name, and has been from the day I was born. If you look closely at the *Wing Commander* galactic map, that's my quadrant at the far left.

Hold on, it's gonna be a wild ride!

David

HORNET F7C LIGHT FIGHTER STATS

Builder: Anvil Aerospace

Length: 22.7 meters

Crew (max): 1

Mass (empty): 22,000 Kg

Focus: Dogfighting / Interception

The F7C is the civilian version of the Hornet F7A flown off of the elite Bengal carrier vanguard of the UEE Navy. While not outfitted for long range runs, the Hornet can take her share of hits … and dish out a consistent, powerful response. The Hornet may be uglier than anything from Origin's lineup, but pilots love it for its rugged reliability.

STRUCTURE STATS

Upgrade Capacity: 6

Cargo Capacity: 4 tonnes

Engines: Aegis Dynamics M-5c "Starwalk" Liquid Fluoride Thorium Reactor

Modifiers: 2

Max. Class: Fusion

Main Thrusters: 1 x TR4

Maneuvering Thrusters: 8 x TR2

HARDPOINTS

2 x Class 1: Equipped 2 x MaxOx NN-13 Neutron Gun

2 x Class 2: Equipped 2 x Klaus & Werner CF-117 Laser Gatling

2 x Class 3: Equipped 4 x Talon Devastator (HS) missiles

2 x Class 4: None equipped on base model

NOTE

On the Hornet F7A the two Class 4 hardpoints are utilized by a Ball Turret with twin Laser Gatlings and a Canard Turret with twin Neutron Guns. The Ball Turret takes 4 Upgrade Slots (it's a ball turret or a decent-sized cargo hold).

Hornet F7C Light Fighter & UEE Naval Pilot

This month's Work In Progress spotlights the development of the Hornet, along with commentary from CGBot (RSI's game 3D artists) and feedback along the way from Chris Roberts ("CR").

The Hornet might be the single ship you see the most throughout the *Star Citizen* universe. As you can read in the development notes that follow, particular care is being taken to make this ship both cool and graphically efficient, so that everyone will be able to keep flying at peak enjoyment and frame-rates.

We've broken this up into three pieces: exterior, interior and the UEE Naval Pilot. Exterior development begins on the next page, while the interior begins on page 13, and the pilot on page 18.
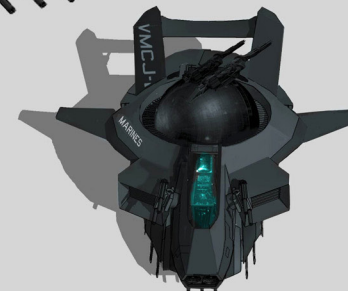
Exterior Development

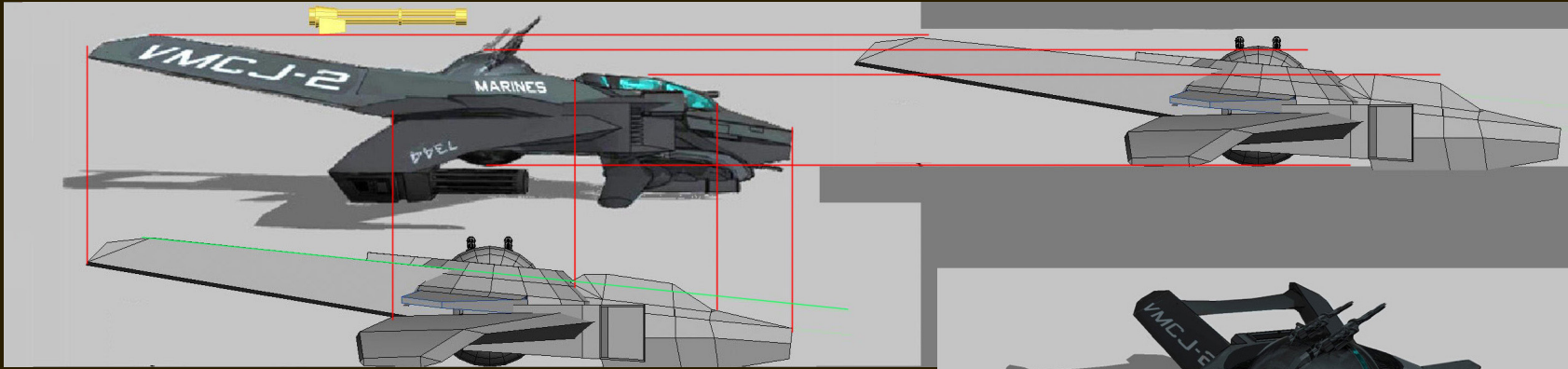**CONCEPT ART:** Everything started with a couple of rough concepts created by Robert McKinnon and provided by RSI, from which we got the initial inspiration for the early modeling stages.

HORNET LIGHT FIGHTER SKETCH

LASER CANNONS DROP
WINGS SWEEP BACK FOR
SPEED

PROPORTIONS BLOCKOUT:
The second step was to find the right proportions, main shapes, the overall style of the ship, and so forth.

CR: I would reduce the wing size and try to make the fighter feel more "space-y." I think extra detail and "bits" (or *greebles*, in sci modeling terms) will help. In general, it should feel like the wings deploy for atmospheric entry and possibly landing and slow maneuvering, but are swept back in fast flight and possibly combat.
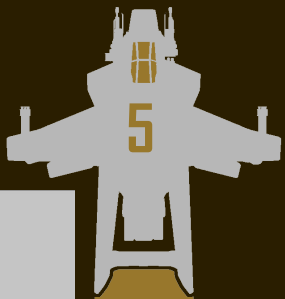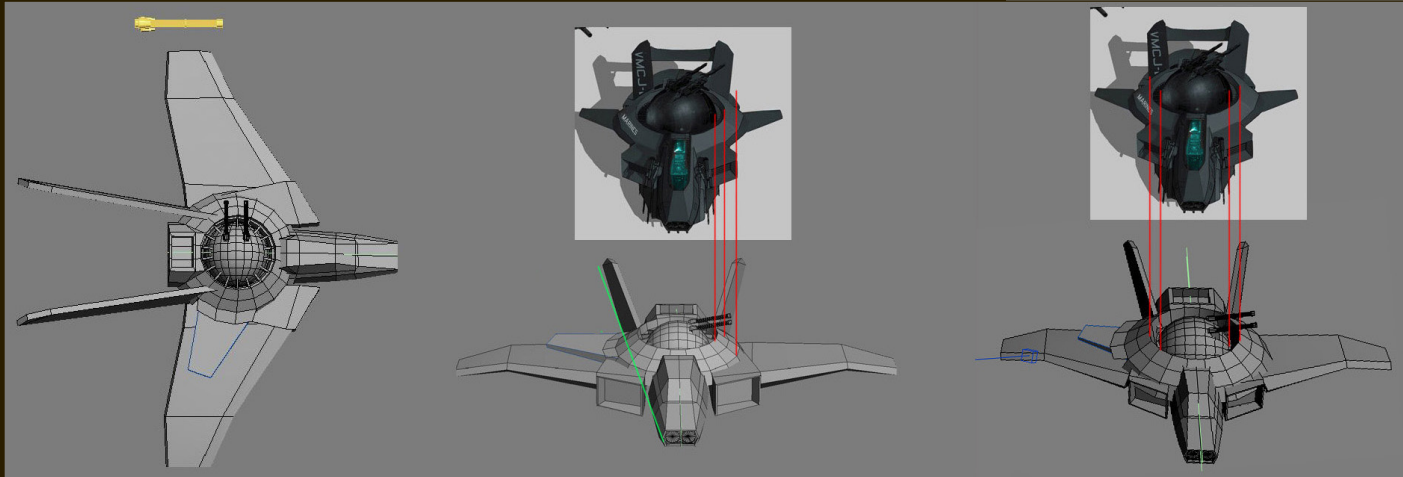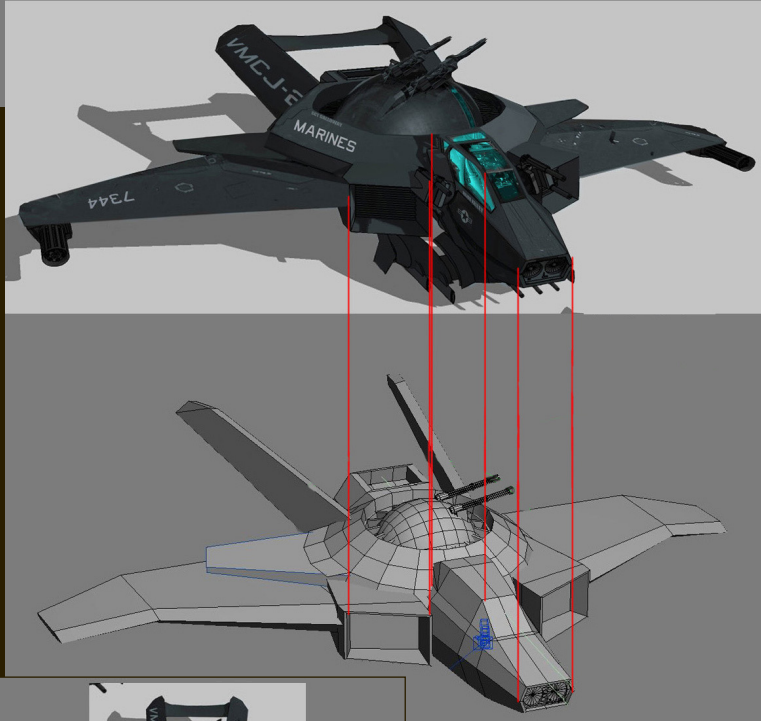
EARLY DETAIL & DIFFERENT ANGLE COMPOSITION:
In this stage we were still playing with the main proportions. We started blocking out the different sections of the ship not shown in the original concept (side, rear, below).

CR: Gatling guns on the main wings should be gimbled / pivoted, as they will track to where the player is focusing (within their limits), and obviously, when the wings sweep back they have to rotate to compensate!

I would be thinking about where we could put some missile pylons.
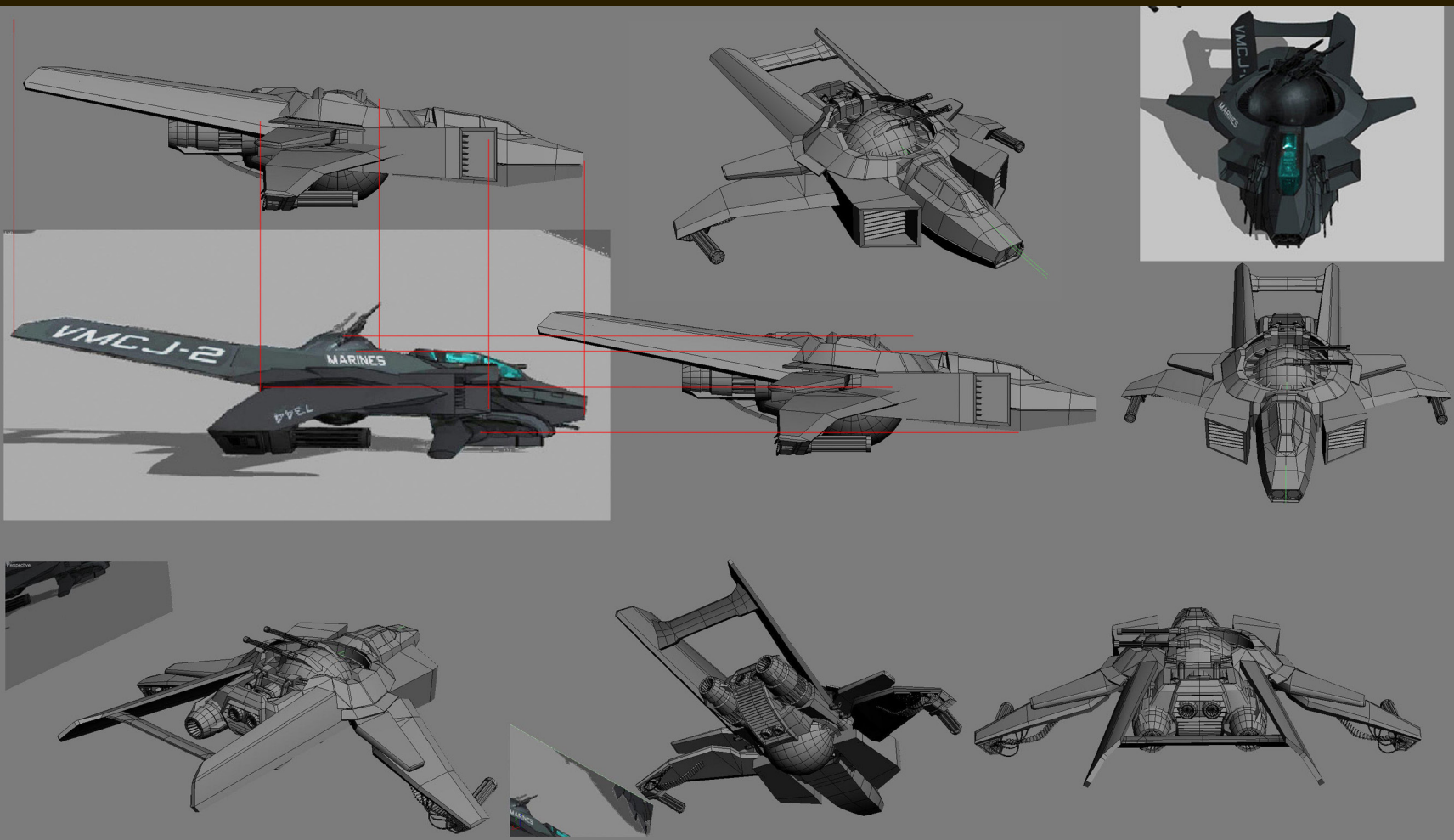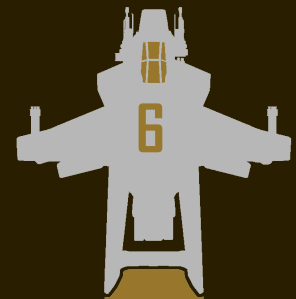
1. SINGLE NOZZLE (3 vector thrust units)

2. SINGLE NOZZLE (w ball joint, beefed up)

3. F14 TOMCAT approach (two engines)

THRUSTERS & DISPLACEMENT LOOKOUT:

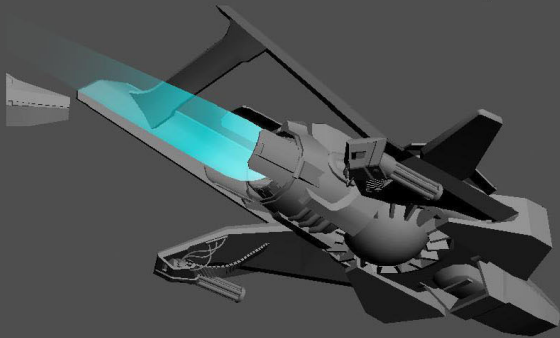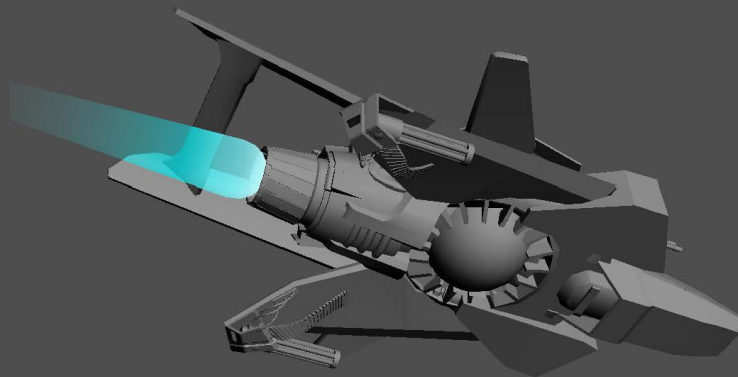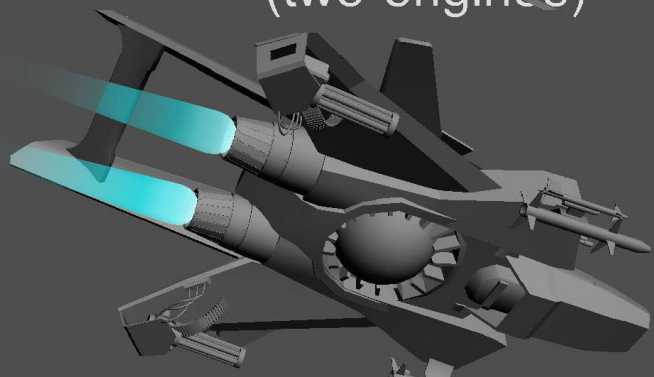In this stage we looked at several real-life references to design the main and secondary thrusters, along with their movement ranges. This was especially challenging because the ship doesn't just follow its nose, but can be flown in several directions — this all had to look logical and possible.

CR: I think I like Option 1 the best — the vector thrust units give the engine / back of the ship more weight, but still keep the ship feeling like a smaller fighter (I think two engines are appropriate for medium to heavy space fighters). I think the vector thrust flaps help balance out the tail wings.

Position 1

Position 2
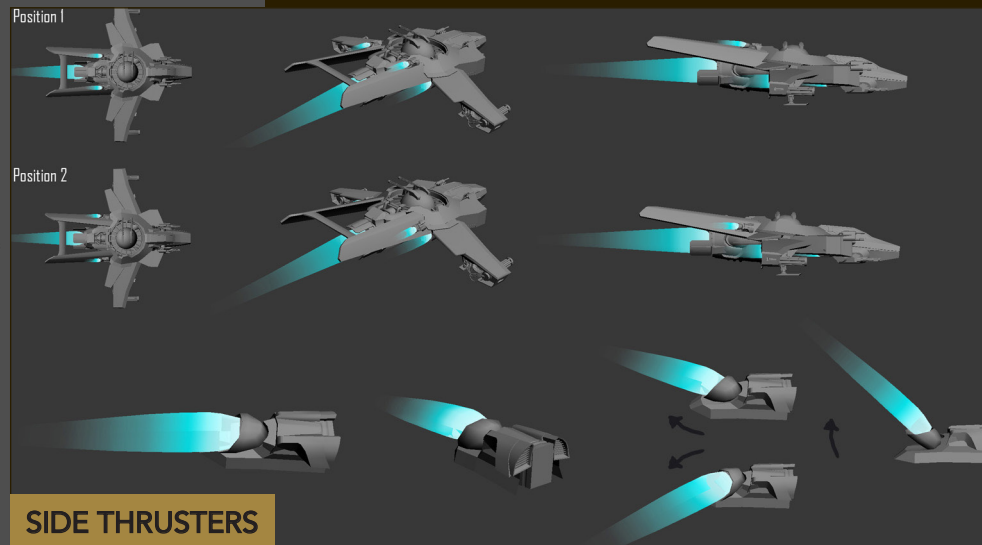
SIDE THRUSTERS

CR: The directional thrusters need to have hemispherical coverage; as it's a spaceship, it needs to have directional thrust in all directions, not just down against gravity. The idea is that there would be thrusters on each side of the ship mounted on a ball joint that could rotate 360 degrees around the X-axis and 180 degrees around the Y-axis.
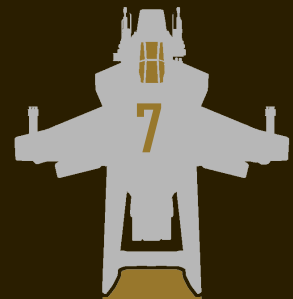
MECHANICAL ANIMATION DESIGN:
This is where we started blocking out all the animations (thruster movement, landing gear deployment, weapon deployment, canopy opening and shutting, and so forth). At this point the whole ship is still a lowpoly mesh, so we could change/improve everything without having to deal with an insane amount of polys.
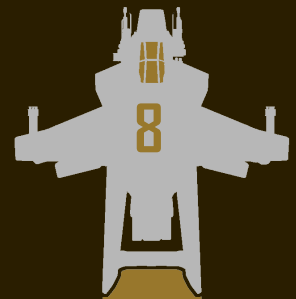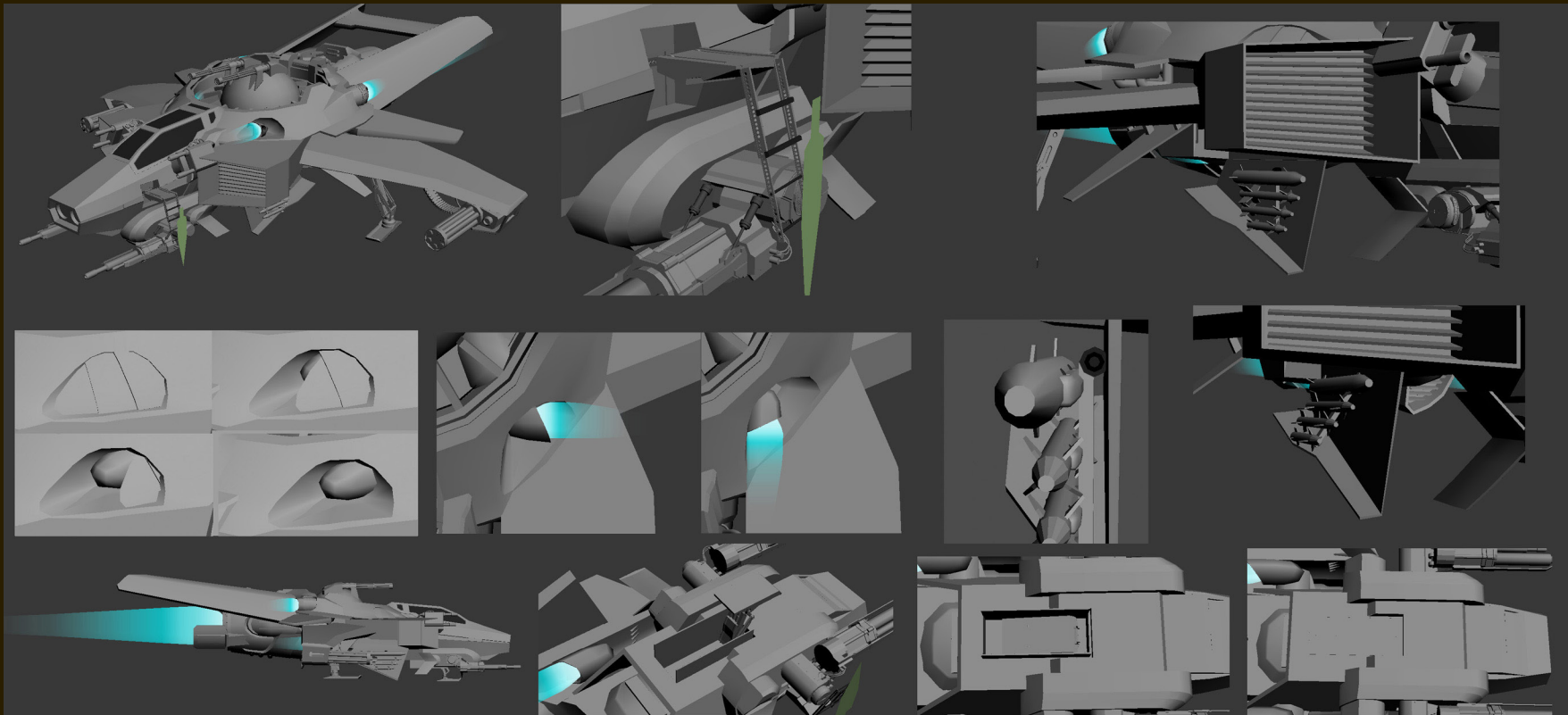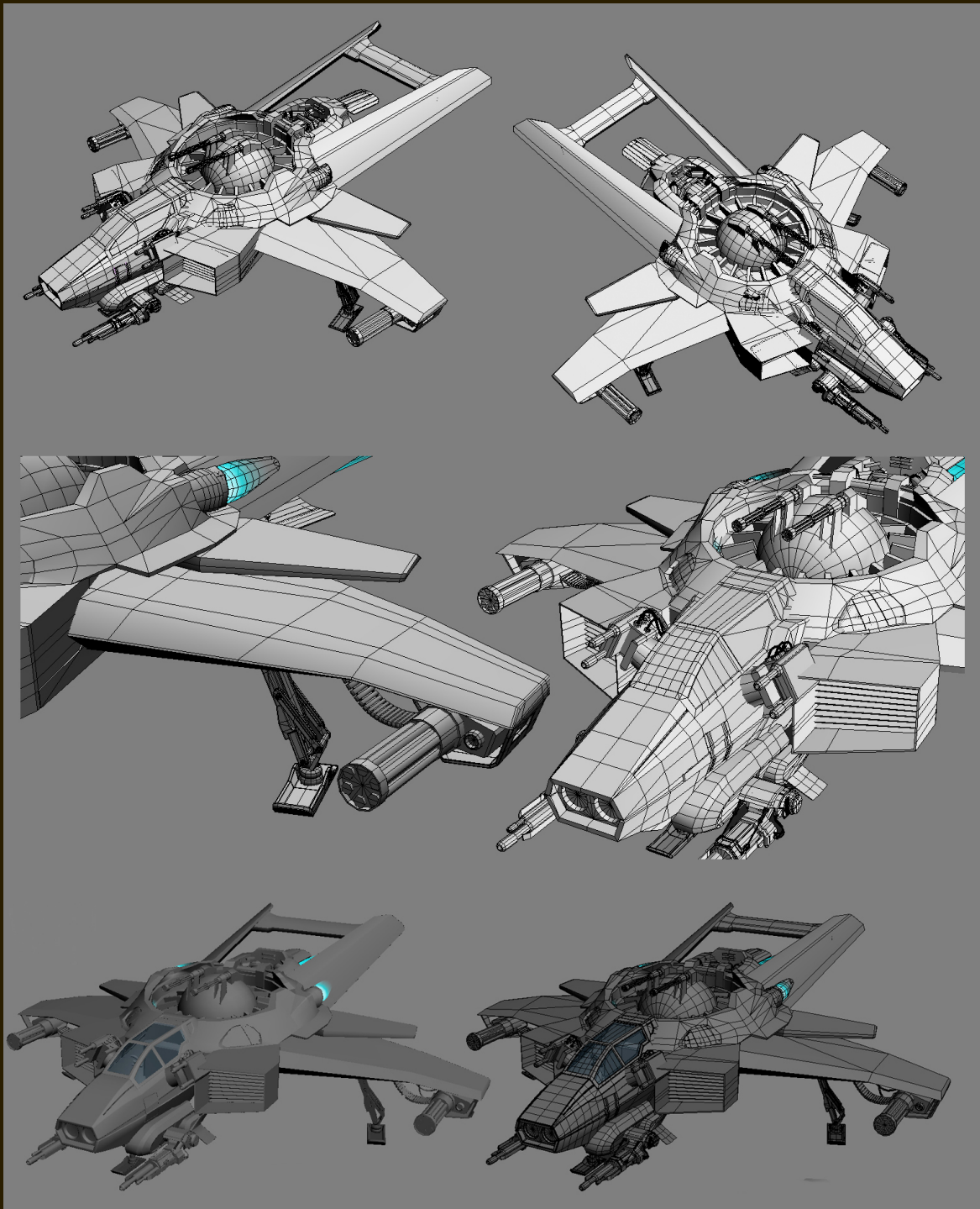
CLEANING UP THE MESH:

After we had all the animations working the way we wanted, we started the clean-up process. In this phase we made sure there was no odd shading, bad geometry or any kind of topology bugs. We also optimized the mesh as much as possible, keeping in mind that there could be dozens of copies of this ship in an intense combat scene!

UVS & BAKES (no images):

After we polished the geometry as much as possible, we started with the UV mapping (which projects a texture map onto a 3D object; "UV" refers to geometric axes, not ultraviolet) and the AO/normals baking process, which approximates lighting and other visual effects on the fly, rather than constantly recalculating them. "Baking" renders complex color and lighting details onto a model texture in order to speed up real-time performance. This phase took some time, because we decided that in order to get enough texture density, we had to use 3 x 2048 sheets (diffuse, normal, displacement and spec).
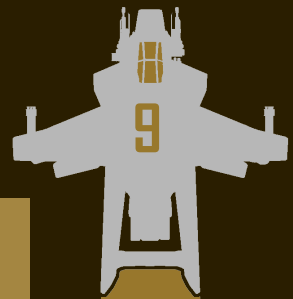
COLOR BLOCKOUT:
During the tedious baking phase we had one of the CGBot concept artists do a paintover with the basic color layout. This way we didn't have to spend a lot of time trying to design the color template 'on the fly.'

CR: The only thing I'm not 100% sure of is the orange / bronze color for the gun muzzles. Love everything else! Especially like the feeling of oil stains and general wear and tear on the ship. Definitely feels like it's been flown! The more of this kind thing — including scorch marks near the engine and thruster nozzles, maybe a laser blast scar or two — the better it will be.

TEXTURING:
This is the stage where the ship really starts to come to life! We added the concept artist color scheme along with more of the scratches, scrapes, burns and many other details to bring all the hard work together!
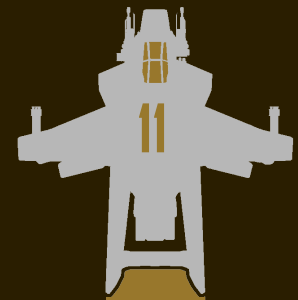
EXPORTING TO CRY:
The next step was to export from 3ds Max and import into CryEngine. This was a long step because we had to ensure that nothing had any errors, including geometry, textures and even animation sequences. Once inside the engine we were able to tweak and play with CryEngine's parameters to get the best results.

Interior Development

DESIGN:
Creating the interior was basically the same as for the exterior; the main difference is that we weren't provided a cool concept. We had to design the whole thing from the ground up ourselves. Here, we've gathered a lot of references that matched the style we were trying to achieve.
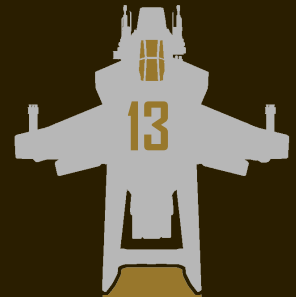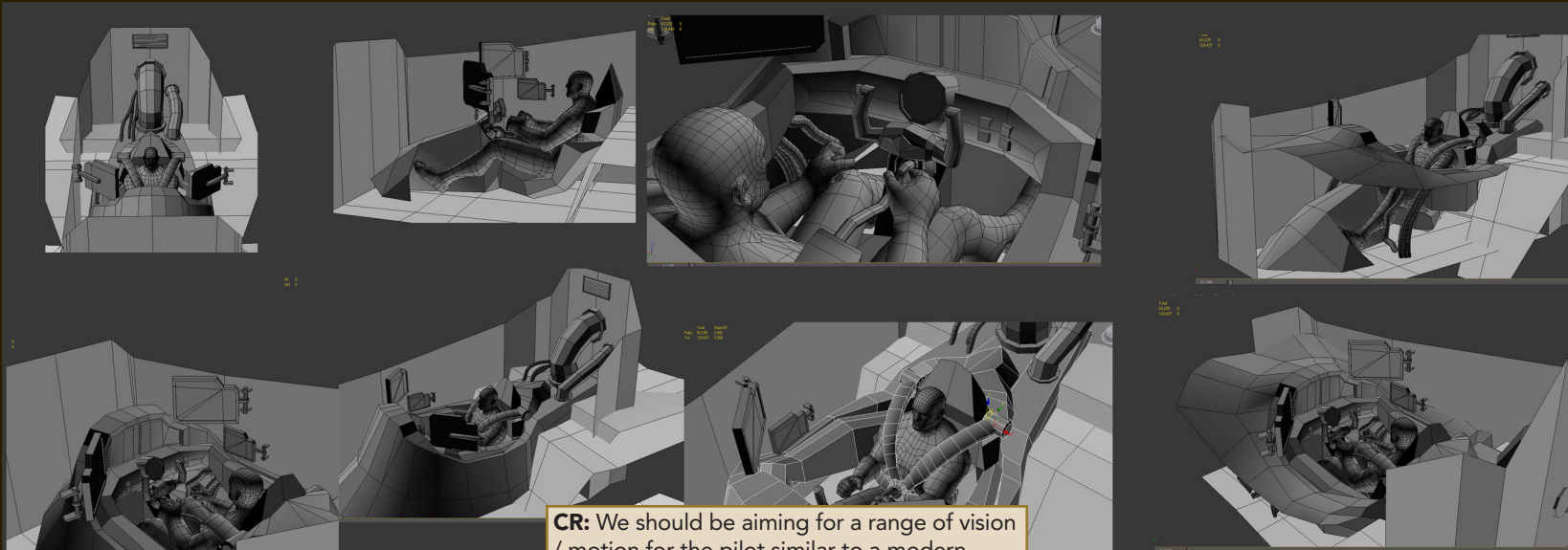
↑ PROPORTIONS BLOCKOUT:
We modeled basic shapes to start
with the main proportions.

CR: We should be aiming for a range of vision
/ motion for the pilot similar to a modern
day fighter jet. For purposes of honing this I
would recommend working on the position-
ing with the canopy over the cockpit and
the camera that simulates the pilot's/player's
view set to about 17mm or 95 degrees for its
horizontal FOV and just slightly in front of the
player avatar's nose.

↓ EARLY DETAIL & COMPOSITION:
Working on detail to establish the
mood.

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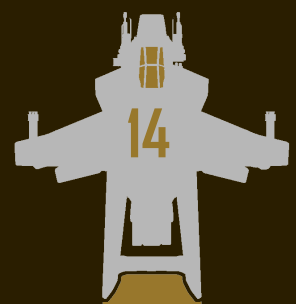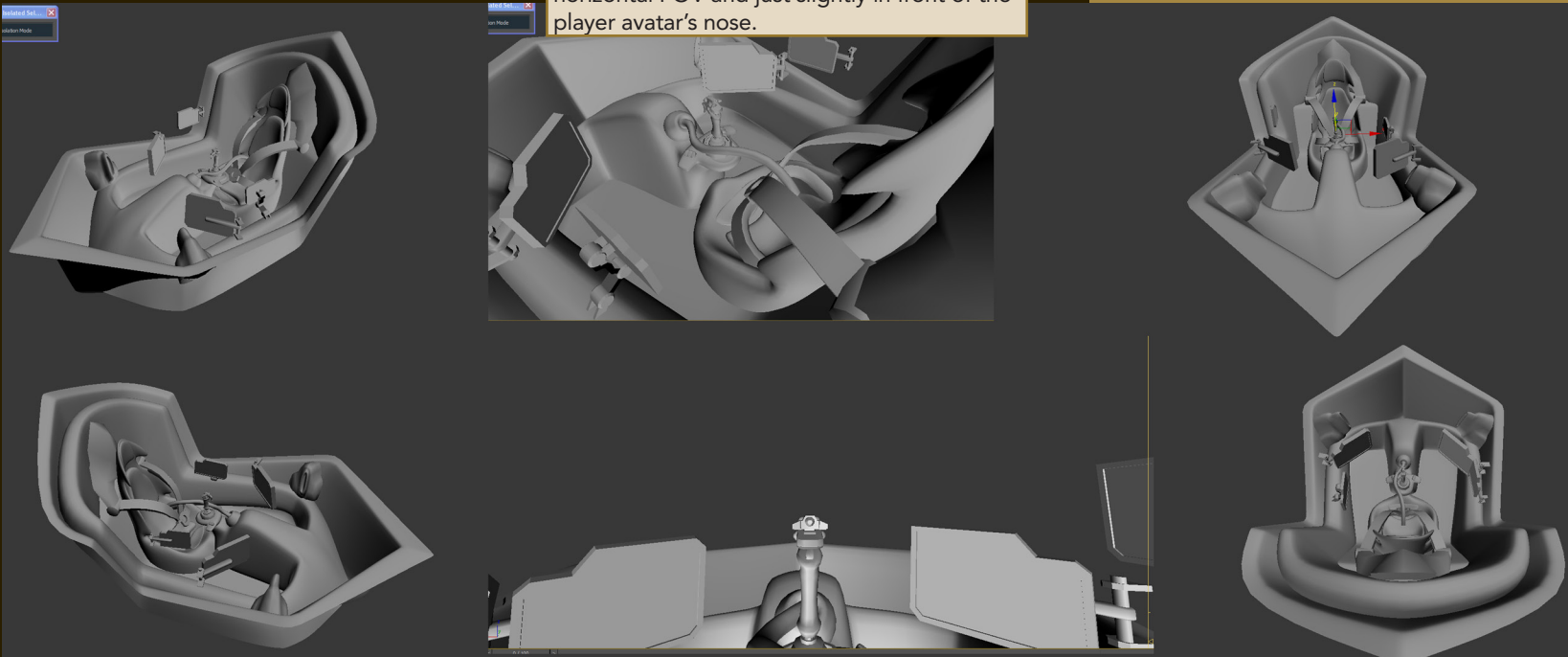
MORE DETAIL & EARLY ANIMATION BLOCKOUT:
Here's where we start working with the way all the interior is going to animate (screens, hoses, levers, joysticks, etc.).

CR: It's also important to have details like where the pilot plugs his umbilical cord, deploying screens, reticules (think the targeting computer that deployed during the trench run in *Star Wars*, but much more sophisticated). Essentially everything should be functional / animated. If you activate missiles, I want to see my pilot's hand flip the switch and then the missile targeting screen fires up (or maybe a special monitor deploys).
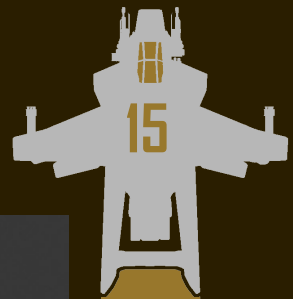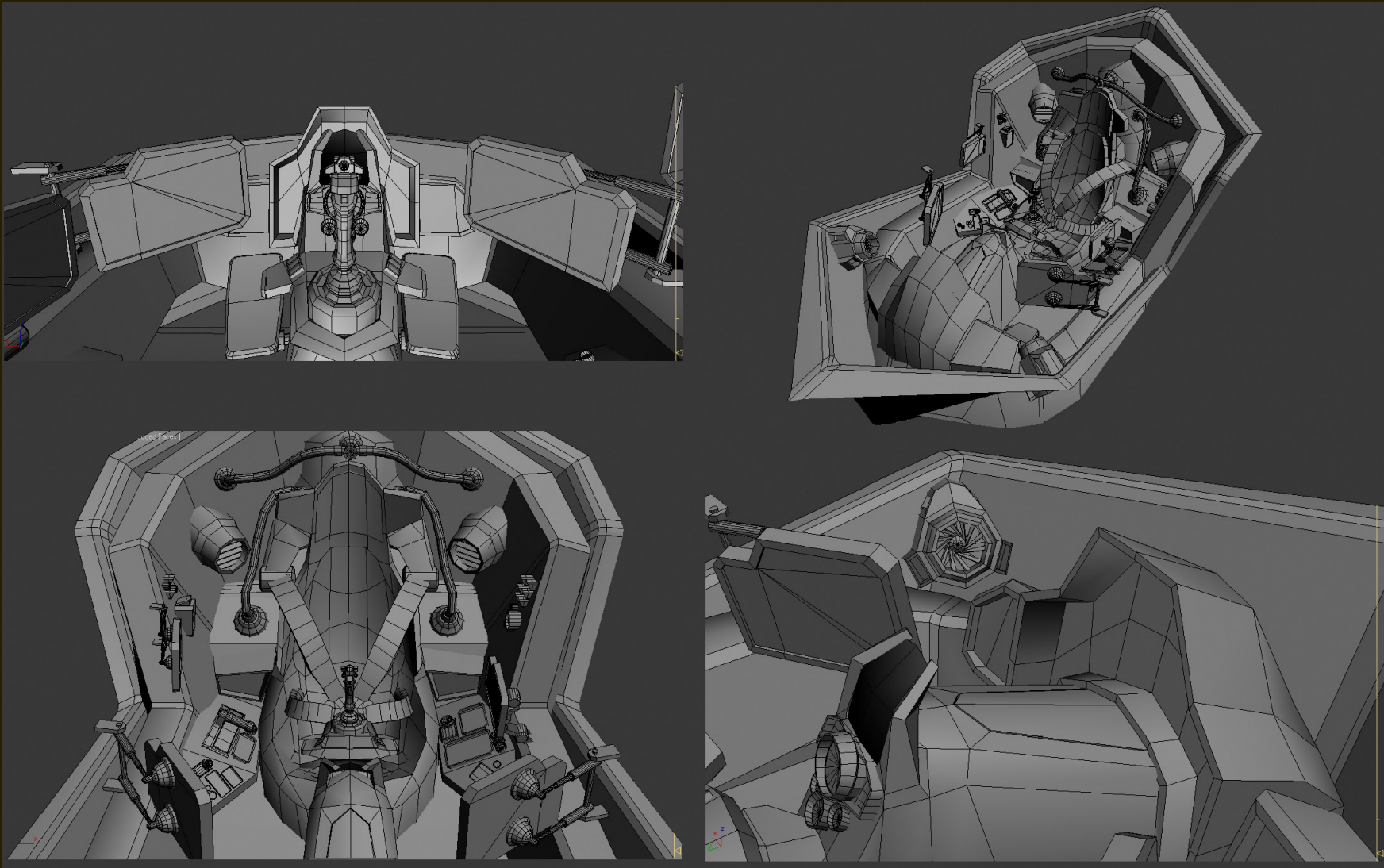
CLEANING UP THE MESH:
As with the exterior, we cleaned the mesh after we had the rough animation blockouts.

CR: It would be great if we could build a feeling of layers inside the cockpit — I really want you to feel inside it (especially in stereoscopic 3D). It's really important for you to feel the movement of your pilot under G force, separate from the cockpit and even a little separate from his helmet! This way I can really give the player a sense of momentum when he's maneuvering his ship.
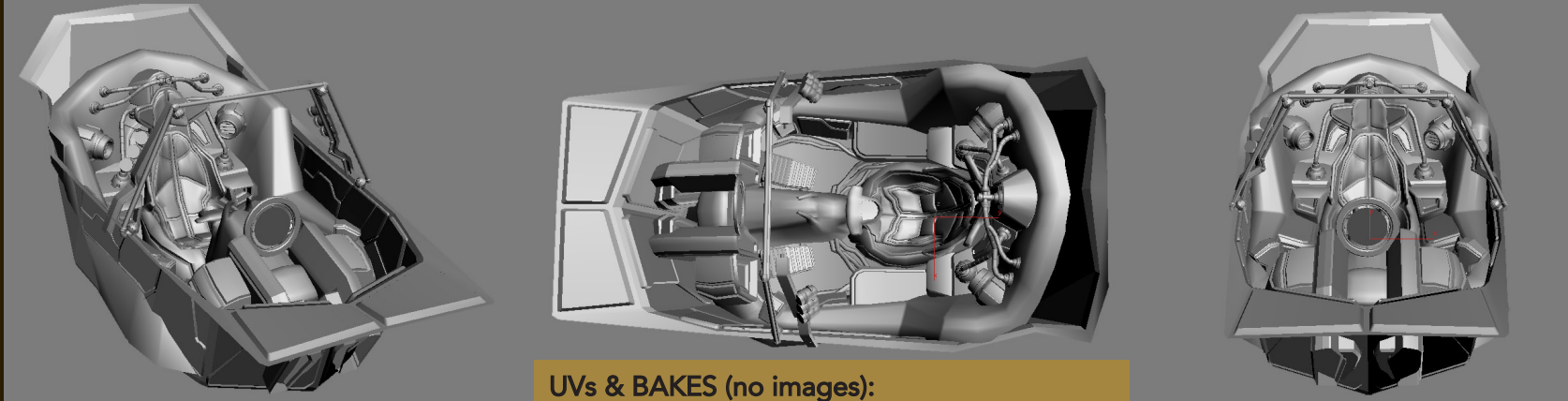
UVs & BAKES (no images):
This was the same process as for the exterior.

TEXTURING:
After we finished with the bakes we started with the diff and all the other textures. For this interior we used three textures: two for all the components and accessories and one for all the screen displays FX. For this stage we didn't require a paintover, because we had already established a style and a mood, so this was easier than the exterior.

CR: Are you going to include a few decals inside? Seems there should be some writing / labels in a cockpit.

It may be cool to have a few of the buttons be a self-illuminating refractive material. It's pretty easy to do in Cry.

Can you make the movil display metal edges be separate geometry, maybe using the cockpit material to be baked into a display screen material / texture? It will make it easier to handle in the game, as I intend to write text, shapes, etc. to the screen texture for the display readouts and I don't want to worry about overwriting the metal boundaries.

CR: It's like Xmas every couple of days at the moment! Once I get everything in and working in the game I think you guys will be happy. We just need the pilot now!

UEE Naval Pilot Development

With a concept to follow (also by Robert McKinnon), the artist started the modeling process by making a rough sculpture to ensure proportions and all detail from the concept are accurately replicated.
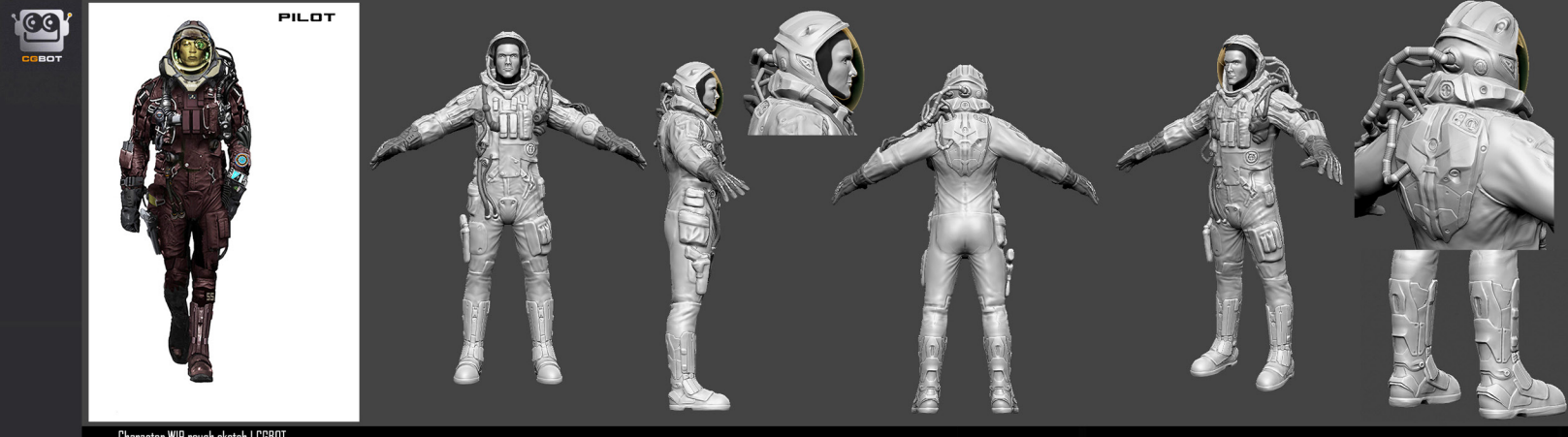
Character WIP rough sketch | CGBOT

Once the rough model has coherence throughout all of his parts, we begin the high-res model phase. All of the pieces on the model will eventually be refined to have a high level of detail and a realistic sense of shape and volume.

CR: Cool! Looks like a good start.

Front and side look like a good start — hands seem a little large relative to the pilot's head; maybe scale them down just a little and increase the head size?

On the profile I would say the helmet cowling seems too big and bulky — especially in the back — I would say it would need to be less deep / protruded. He has to sit in his pilot seat, after all.

Character HP | CGBOT
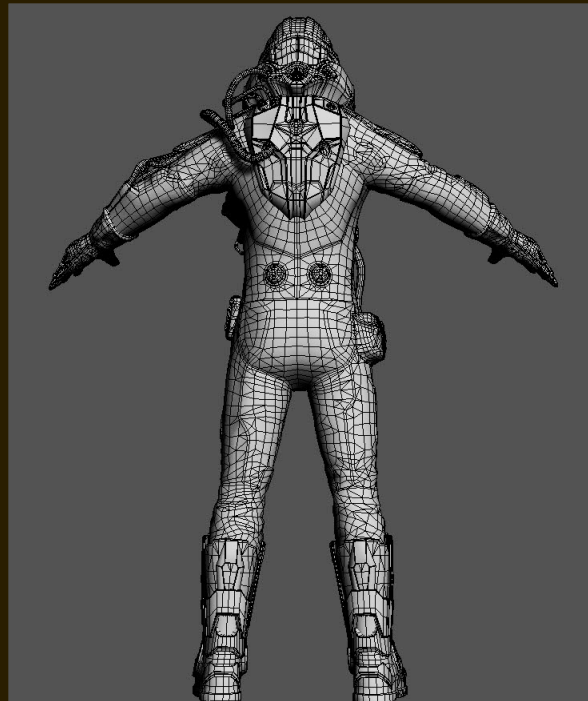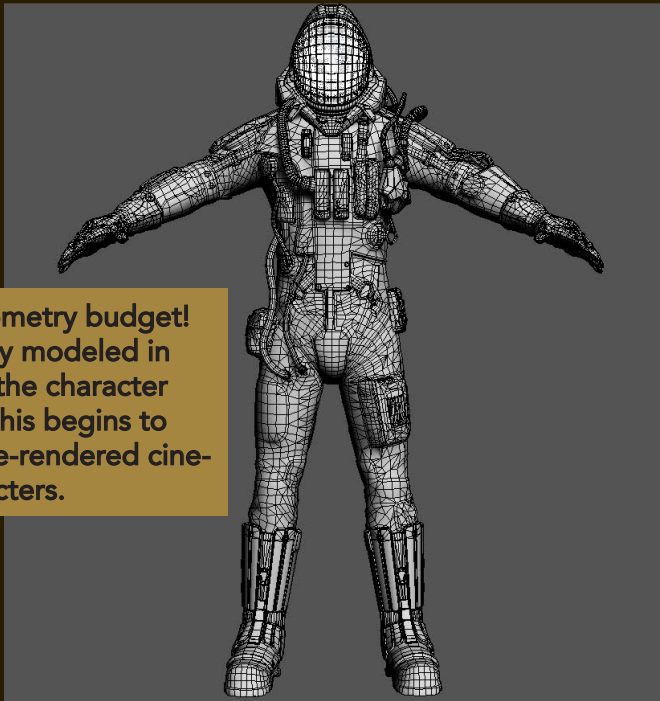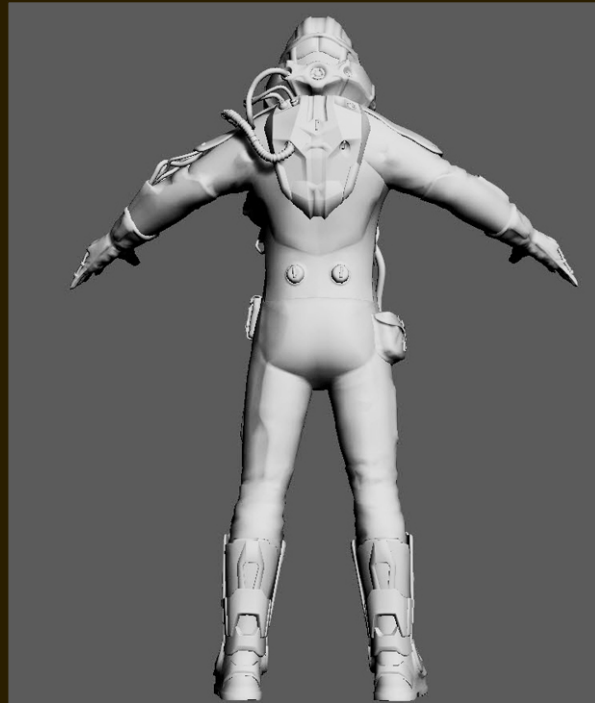
Hurrah for a next-gen geometry budget! Lots of cool details actually modeled in the "low poly" version of the character make it look really solid. This begins to erase the line between pre-rendered cinematics and in-game characters.
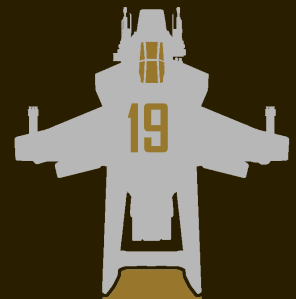
WORK IN PROGRESS
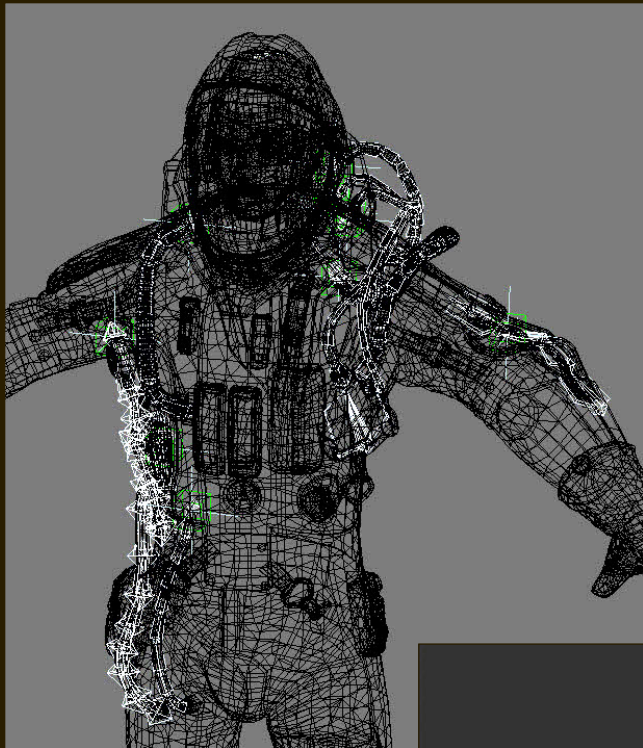
… Along with a next-generation rig. The pilot's exterior isn't the only thing to benefit from the newest technology. Bone and skeletal systems have also been given more detail. Having hoses and wires IK rigged gives it more realism and coherence when the character moves.

Normals maps and AO baked textures on the low-poly mesh with a color block-out.

Game Rez Model with BLOCKED OUT COLOR WIP TEXTURES

Low Poly with Very WIP Blockout Textures | CGBOT
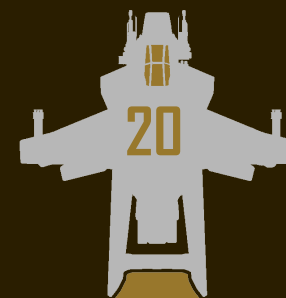
In-Engine Materials & Texture Tests

CR: How cool is that! Love the glass!
Love the glow bits on the life support set up.

WORK IN PROGRESS

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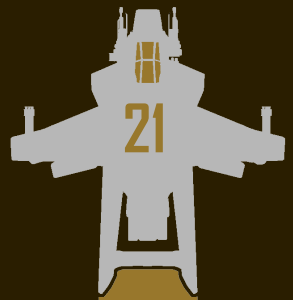
In-Engine Materials & Texture Tests

WORK IN PROGRESS

22
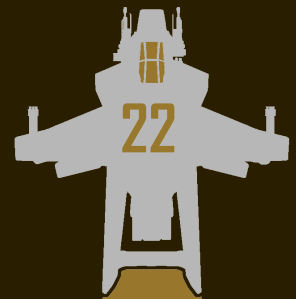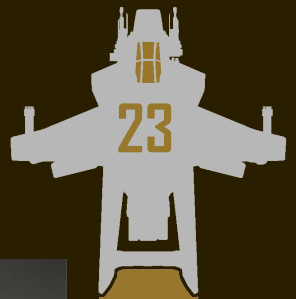
Anvil Aerospace is one of the earliest Terran success stories. Founded in 2772, Anvil has been reliably delivering military-grade equipment to the UEE navy for almost two centuries. The initial Anvil skunkworks facility was located in Nova Kiev, Terra, and the company's headquarters are still there. For the first seventy-odd years of Anvil's existence, every design project was personally lead by company founder J. Harris Arnold. Arnold, an eccentric spacecraft designer of the old school who insisted on signing off on every part of his designs' subsystems, was a beloved figure in an otherwise cutthroat industry. Today, Anvil has factories on three dozen UEE core worlds … but continues to source all systems itself and requires that the standing CEO sign off on every spacecraft alteration.

The company's moniker comes from a quote in Robert Calvin's famous early justification for UEE expansion, explaining that military spending "fuels the furnaces of expansion and strikes the anvils of innovation." There's little argument: fueling the furnaces of expansion is exactly what Anvil has been doing since Day One. The company has produced dozens of successful and iconic military spacecraft over the years, including the Hurricane, Osprey, Devastator, Hornet and Gladiator. No military campaign in the last two centuries has been launched without Anvil spacecraft in the forefront, and no carrier in UEE space today operates without at least a squadron of Anvil-designed fighters. In fact, Anvil designs have historically scored more space-to-space kills than any other military spacecraft. Hornets, in particular, have destroyed more enemy hardware (measured in star credits) than all other current Navy space fighter designed combined.

Core Craft

Today, the F7A Hornet is emblematic of UEE military superiority. Hornets grace recruiting posters in every corner of the galaxy, and the lives of the fighter pilots who fly them — off of the elite Bengal carriers holding station on the frontier — are not at all unlike the stars who play them in holofilms like Chain of Command and Strike Leader. With proper tactics, Hornets have shown to be wholly effective against Vanduul raider craft, with an armament capable of delivering a stinging blow to even mid-sized Vanduul capital ships. In one recent instance, a lone Hornet assigned to shadow a fuel convoy was cornered by three raiders and was able to eliminate all three without suffering heavy damage. The pilot, name withheld for security reasons, was awarded the Navy Cross for the engagement.

Anvil also produces the Gladiator, a carrier and port-based bomber used throughout UEE space. Gladiators carry torpedoes needed to pierce heavier capital ships and installations, and are also (if increasingly rarely) used as dive-bombers in space-to-ground strike missions. With a defensive turret and drop tanks capable of unmodified cross-system travel, the Gladiator is an excellent battle platform. A high degree of configurability, rare in a military model craft, means that Gladiators can be retrofitted aboard carriers as SWACS craft, S&R ships or even trainers and target-tow craft. In spacedock, Gladiators can be fitted with everything from a jump drive (reducing bomb load) to a holo-targetting emitter. A true "where you need it" spacecraft, the Gladiator, like the Hornet, is among the UEE Navy's most favored tools.

PORTFOLIO

Civilian Craft

Anvil's civilian line is relatively new, a decision that many at the company initially resisted. The general feeling was that producing civilian grade versions of dedicated military spacecraft would dilute the brand: Anvil's carefully maintained position as the tip of the spear would be in danger. Debate over the issue became so protracted that it threatened to split the company into two separate groups, with the civilian wing formally licensing the military designs. This was ultimately all for naught, as the UEE government stepped into the debate with a surprising resolution: they actually favored the concept of supplying military-styled weaponry to civilians, especially on the distant frontiers. A home defense militia squadron of slightly-less-than-milspec but still fearsome Hornets, it was reasoned, would make a better deterrent than a squad of Drake Cutlasses.

The process of civilianizing a design like the Hornet is more complex than it seems: UEE military secrecy laws mean that, on average, 60% of the hardware in a given spacecraft simply cannot be offered to the public. Some of these replacements — like milspec Gatling guns — would be expected and relatively easy to re-source in a modern modular design

… but these requirements also govern systems as innocuous as rudder pedal boot locks or rubber cockpit sealing strips. Design teams must effectively work double-blind, replacing existing systems without being given access to their military equivalents. In some cases, designers must reconstruct subsystems based solely on publicly available holographs … while the team that designed the original systems operates next door, wholly unaware.

Civilianizing top-of-the-line military spacecraft is a frustrating process, but one that has proved ultimately valuable for Anvil: company profits rose 34% after the first civilian model Hornet (the F7C) was made available, with no perceptible tarnishing of the Anvil brand. Rather, the idea that you could own a "military" ship immediately became something of a status symbol, driving the resale value of Hornets and successive conversions; civilian Hornets have essentially (and unexpectedly) become a luxury brand. Anvil's civilian equivalents sell both to actual paramilitary units on the frontier desperately in need of rugged hardware and to rich homeworlds industrialists who believe that flying a Hornet makes them top gun fighter pilots.

The Future

With both military and civilian spacecraft spending at an all-time high, Anvil's prospects look bright. As the UEE continues to face off against a seemingly growing Vanduul threat, orders for Hornet space superiority fighters and Gladiator bombers continue to spike. Several thousand of each are delivered to front-line carriers every month, at a rate that continues to rise as additional factories can be brought online. On the civilian side, the Hornet is holding steady as the third best-selling single-seat spacecraft design available, trumped only by the Aurora and 300i. The recent civilian conversion of the Gladiator looks to be a similar success story, as the first model (Gladiator I) becomes available to the general public in the next three months.

An Interview with Jason Spangler

We had hoped to interview Jason for this month's issue, but it wasn't looking good since he was totally off the grid, backpacking in Texas' Big Bend, until the last couple of days. He got back just in time to meet our deadline.

JP: *What is your title and what will you being doing on* Star Citizen?

JS: I'm Chief Technical Officer at Cloud Imperium. I'm responsible for the technical side of all development at the studio, including *Star Citizen* and *Squadron 42*. This includes building up the engineering team and hiring engineers, working with the team to evaluate and choose technologies and do technical designs for our development, reviewing implementation of systems with the engineers, scheduling and planning of programming, and working daily with the engineering, art, design and production teams to coordinate programming with them and make sure we are developing what they need. We work in a very cross-discipline manner to get the best results for players.

JP: *Tell us a little bit about yourself outside of your game design life.*

JS: I have a lot of interests, including technology, nature, hiking, native plants, conservation, green building and energy efficiency. I have been board president of a prairie conservation land trust non-profit and also helped organize a native plant gardening and conservation conference. I also play *Minecraft* with my young nephew who lives in another state, and have a decent LEGO collection of classic space, castle and town sets.

JP: *How did you get into the game industry?*

JS: I was a huge fan of Origin games when growing up — including the *Wing Commander* and *Ultima* series. I played the heck out of those games; I even wrote to the studio asking them how I could get a job there and got a great letter from Dallas Snell in response.

After college I submitted my resumé to Origin, which had just started development on *Ultima Online*, and was hired as a programmer on the project.

JP: So you were a fan of Chris Roberts' games before you got into the game industry yourself?

JS: Definitely! *Wing Commander I* and *II*, along with the *Secret Missions* expansions and *Privateer*, were my favorite games back then. They are half of the reason I got into the game industry and worked at Origin (*Ultima* was the other half).

JP: I understand you're something of a poet — what's the story there?

JS: I entered a poem about *Wing Commander* in a game poetry contest held by *Computer Gaming World* (a popular print computer game magazine at the time) and it was published! I lost my copy of the magazine during my moves however — it was around 1991, I think. I do remember something like, "Blast those kitties from outer space!"

JP: Have you worked with any of the Star Citizen *team before?*

JS: I worked with Michael Morlan at Origin as well as David Ladyman (editor of this very magazine). I think Chris and I missed each other by a few weeks at Origin.

JP: Much of your career has been spent working on traditional fantasy massively multiplayer games. Is the process behind Star Citizen *the same, or have you encountered any differences working on a space game?*

JS: Much of the development process can be the same — but dev processes differ at every studio, even ones making the same genre of game. On the technical side, rendering budgets and areas of concentration for space games are different; much less worry about terrain so we can use that budget for cool space, ship and weapon effects. We also need to worry about latency more than a fantasy MMO, since ship combat is faster and more skill based.

JP: What's the biggest challenge building Star Citizen, *from a technical standpoint?*

JS: The game is very ambitious — we need to work very smartly and use as much existing technology as possible so we can concentrate on developing gameplay and the features that don't exist in existing reusable technology. Other technically challenging areas include adapting CryEngine for a large space game, allowing characters to move around in the large ships while ship combat is occurring outside in space, and the server backend to support all of it.

JP: You've worked on both Klingon Academy *for Interplay and* Old Republic *for EA … so you're in a unique position to answer the age-old question:* Star Wars *or* Star Trek?

JS: I'm going to cop out — I like both for different reasons! They've both had their ups and downs too. However, *Star Wars* does have fighter dogfighting that is lacking in *Star Trek* …
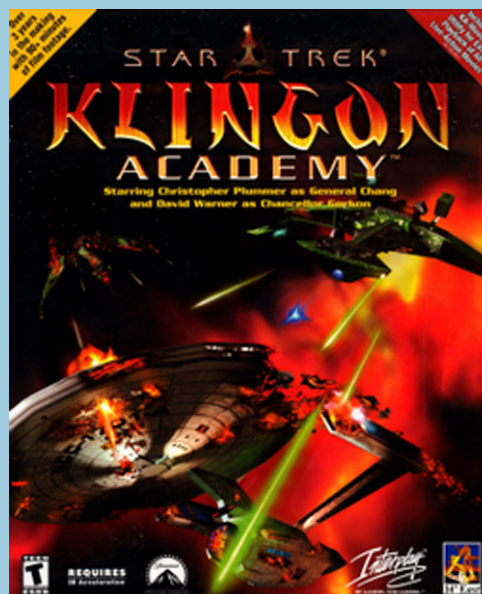
JP: Ultima Online *was the first commercially successful "massively multiplayer" game, and the standards it set continue to impact new games today. What have you taken away from your experience working on that title?*

JS: *Ultima Online* was a huge learning experience for the game development industry at large and for me personally. Things I learned include:

* Developer excitement and passion can really show through on a game, as developers create features they love and want to get to players to enjoy.

* Plan for both good and bad player behavior and make sure the majority can still have fun even if the minority are trying to grief play.

* Player driven gameplay can be much more interesting and fun in the long run than fully scripted content.

* Don't release unstable code — do load tests and test with production data!

JP: *Have you pledged for* Star Citizen? *What are you most excited about seeing in the finished game?*

JS: Yes, I pledged back in November via Kickstarter. I'm really excited about cooperating with friends inside the larger ships, the player-driven economy, and modular ship systems, among other features!

ULTIMA ONLINE
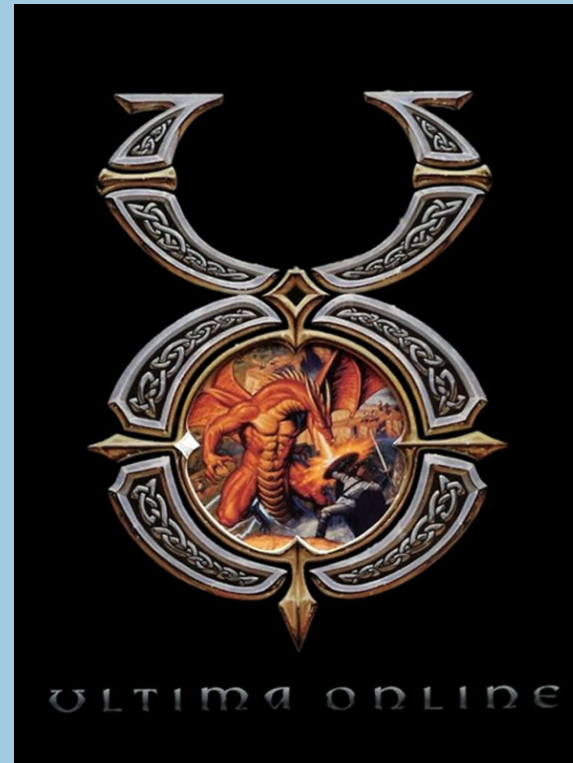
Our intrepid team of crack investigators (okay, one guy with a complete set of *Computer Gaming World* and too much time on his hands) tracked down Jason's entry in a short-poem contest published in the December '92 issue. The verses were in response to *CGW*'s request for poetic answers to "what have you been playing lately?"

Blast the kitties out of space,
Fire particle cannons in their face.
Turn Kilrathi ships into waste,
Save the missiles, just in case.

Thanks to cgwmuseum.org for their complete set of *CGW* PDFs that made this vital research successful.

Cathcart System
Spider

Origin

Astronomically speaking, Cathcart is basically void: a star with no true planets and only a loosely defined chain of asteroids and worldlets orbiting far from the theoretical green band. In theory, there is no reason anyone should ever have lived here. What is now known as the galaxy's junkyard came from humble beginnings. The system was first charted roughly five centuries ago and almost immediately abandoned. It was initially listed as a Class C military restricted system, with plans to construct a listening post complex … but rapid advancements in scanning technology meant that large-scale orbital listening posts no longer needed to be built so far from the core worlds. The Navy abandoned the partially constructed habitat platform structure to the void … little realizing where it would lead.

Then, the system spent almost two hundred years as a government dumping ground. Seeking to create a series of spatial 'boneyards,' the UEE selected Cathcart as an ideal (if distant) location for storing decommissioned spacecraft. The reasoning was simple: without planets or other major bodies, spacecraft could be easily stored in the void of Cathcart's deep space. Craft stored there, far from most environmental influences, could be easily reactivated in times of crisis. A pair of pre-fab processing factories were towed in-system and for decades the system began collecting all varieties of obsolete military spacecraft: fighters "parked" in space, end to end for hundreds of kilometers; abandoned destroyers, cruisers, frigates and carriers; all stripped of various needed or classified systems, berthed together as far as the eye could see.

But Cathcart was out of sight and out of mind from the UEE command structure. Spacecraft decommissioned from the nearby frontier could easily be left there … but without access to the homeworlds' supply chain, they were too expensive to effectively scrap and too difficult to re-crew or maintain for crisis. As galactic expansion moved beyond the Cathcart region, the UEE effectively abandoned the area. Eventually, the spacecraft salvage rights were sold off to the highest bidder and the entire system was reclassified as private industry.

Transformation

That's where Cathcart's history becomes fuzzy. The system quickly became a 'trash pile' for private industries wishing to dump crippled hulls, toxic materials and all other varieties of odds and ends. Who the first pirate was who realized the universe's largest man-made mess could be a reasonable home is lost to history, but by 2750 Cathcart had a well ensconced pirate population. Individual pirates and smaller clans made the surplus military and civilian hulls their homes, retrofitting them with makeshift atmospheric containment systems and eking out an unlikely living, preying on each other as much as they did on convoys passing through nearby systems.

Enter Spider, a sprawling world-sized mass of crippled starships, abandoned colonizers and ancient platforms, all held together with pleximetal and prayer. Spider's origin story is more the realm of myth than recorded history. Clan legends claim its creation was overseen by a unified pirate alliance which constructed the planetoid together. Tens of thousands of pirates and smugglers worked alongside one another, lashing together old habitat modules, destroyers, carriers and colony ships to form a living, breathing city … of sorts. Modern anthropologists consider this story unlikely, pointing out that pirate organizations have never been able to work together for very long. In all likelihood, a single pirate clan spent the lives of countless imprisoned slaves to construct Spider, and then lost control over the facility during an inter-clan conflict. Whatever the background, Spider is now one of the most fascinating domains in space: by far the largest place in the galaxy where pirates openly congregate, and unique in that it has garnered enough respect for even the larger groups to treat it as an effective free port.

Spider remains the only commonly 'known' pirate facility. The UEE is as aware as any citizen is, but is unwilling or unable to expend the treasure to destroy the facility. Many speculate that Spider plays an important role in keeping piracy organized … and that it is not in the government's best interest to scatter the various clans to the winds.

Protocol

The first thing to remember is that Spider is always changing. The abandoned Indefatigable-class battleship you docked with to purchase narcotics a month ago may be an agro-habitat today … or it may have been blown out into space after a pricing dispute with a no-nonsense buyer. Spider is also constantly expanding: junk located in Cathcart and crippled prize ships are added to the maze on a daily basis. Understandably, taking a wrong turn can be extremely hazardous to your health.

When you enter Spider's airspace, you take your life into your own hands. No insurance company will begin to insure a spacecraft visiting Cathcart. The only thing going for you is the fact that it is the rare domain where pirates will almost

never turn on their own. If you are accepted as part of a pack, the wolves will not strike.

Establishing your credentials can be tricky. Without the right codes — available for the right price in surrounding systems — you won't survive a minute from arrival in-system. While

there is no organized government patrolling Cathcart, plenty of low-caliber pirates hang around the jump point waiting to prey on hapless travellers. Begin signaling your ID codes before you enter the system; take no unnecessary chances here.

Spider itself, the largest gravity source in the system, can't be missed, but if you need to fly on autopilot it is at 145 mark 200 mark 30 (Nav 7 if you are using an ACorp standard projection unit). A docking approach is, again, tricky. In short, the process changes constantly: the most recent docking protocol (which we warn you may be obsolete by the time this article is published!) is that you need to signal a tower four times for an approach vector. Any other number of signals will immediately designate you a target.

Once you're in, though, you're in! Culture aboard Spider is deceptively pleasant: everyone knows themselves to be in the company of thieves and any business done is no more or less honest than you would find in a public square on Terra. Don't anger the locals, of course, but that's good advice on any world. One important note: every segment of Spider has a different decompression alarm … so watch for flashing lights, beeping sirens or anything that might be trying to get your attention. The energy fields that contain the atmosphere are in no better repair than any of the other systems on Spider … so don't be separated from your helmet and pressure suit.

At the center of Spider's winding ramps and disparate starship hulls is a makeshift pirate court for settling on-world disputes, part of a fascinating and so far unexplored pirate subculture now taking shape. Appropriately, this is located on the unfinished platform hull that the Navy initially designated to be a listening post. Beware — disputes are most often settled the old fashioned way: with a duel to the death. Visitors are encouraged to bet on the outcome!

Market Deals — Spider

BUY:	NARCOTICS (ILLEGAL)	+7
BUY:	SLAVES (ILLEGAL)	+5
BUY:	BIOLOGICAL GOODS (ILLEGAL)	+5
BUY:	WEAPONS (OBSOLETE)	+8
SELL:	LUXURY GOODS	+4
SELL:	CLASS 4 FOOD	+3

Commerce

What can you sell on Spider? Basically, anything … with a clear preference for luxury goods. Those trying to build a life on the artificial world crave anything from the homeworlds — high quality foods, games, books, electronics and the like — and will always pay a premium for them. Illegal resources are not in demand because they are usually in surplus: go to Spider if you need to buy drugs, bootlegged products, slaves, cybots, human organs or stolen goods of any sort. You will probably find what you're looking for; if not today, then

Market Deals — Hidden Gems

Spider isn't the only landing platform in the Cathcart System … so keep an eye out for stray signals that might lead you to one of the smaller bases. They're kept off the map with good reason … but if you can locate one, you'll get an amazing deal on its specialty illegal cargo!

within a week. Owing to its origin as a junkyard, Cathcart is also a great place to pick up ship upgrades … if you don't have a problem with technology that may be a century or two out of date!

Last Flight of the Seraphim

by David Haddock

PART TWO

The pirates known as the Scourge will return when the metal refining station on Garron III completes its current processing run; Dr. Harroway and the rest of the settlers have less than three months to find salvation. The remaining members of the Seraphim Wing, now a team of mercenaries, could be that hope . . .

The sun had long set on Vega II but the sky churned with the iridescent swirl of violet and green light. Armitage, Shen, and Lott listened as Dr. Harroway explained his predicament in detail, describing among other things Oren Vik and the other Scourge, the number and types of ships that took part in the raid, and the timetable of their return (now two months Garron-time). Eventually Harroway stopped talking and looked at the three men.

"I think that's everything," he said.

"I'll say." Shen stretched his back. "For a second I thought you were going to describe their hairstyles."

"I'm sorry, I know I tend to over-report." Harroway laughed nervously. "This is all new to me, so I don't really know what's helpful and what's not."

"Where the Scourge are located would count as helpful," Lott said under his breath. Armitage shot him a glare then turned back to Harroway.

"It's all right, doctor." Armitage retrieved the pitcher of water and refilled Harroway's glass. "There's no such thing as too much information."

Harroway smiled and sipped from the glass. Armitage turned to Shen and Lott, then nodded outside. The mercs filed outside onto the balcony.

Armitage quietly closed the door and turned to them.

"So, what do you think?" He leaned on the railing and admired the aurora.

"Our first hurdle is getting to the planet," Shen murmured, tumbling the situation over and over in his head. "I assume the Scourge are watching the colony, so three fighters approaching will definitely set off their alarms."

"Good point," Armitage nodded. "We could try –"

"What's he paying us?" Lott interjected. Armitage and Shen both looked at him.

"These people need help," Armitage fired back.

"Yeah, they do, but I don't see you calling up your old war buddies to help out."

"It's not their business." Armitage glared at Lott.

"Good, so we agree it's a business now, and they're asking us to take on twelve to fifteen pirates which are crap odds on a great day. So I want to make sure we're not getting shredded up for pocket change … again."

"It's a fair price," Armitage finally said. "Move on."

"Yeah? Fair to who?" Lott fired right back. Armitage snatched Lott by the collar. The old man was still quick.

"Whoa, whoa." Shen leapt up and pried the two apart. He turned to Lott. "Calm down, man. What's the matter with you?"

"I want to know what risking my life is worth."

"We used to do this kind of thing for nothing," Armitage said, his voice wavering.

"Well, not any more. We're weapons for hire now."

"But you're right, I screwed up that last job and we lost Clark." Armitage wrenched himself free from Shen's grip and moved to the opposite side of the balcony. "And for what? So some exec could do a tour through enemy space. That's it. Nothing more." Armitage gripped the railing tightly, his knuckles turning white. "I don't know about you, but I'm tired of putting my life on the line at the whim of the rich and powerful just because they can afford it. But this? Yeah, we'll get paid,

sixty thousand each since you care so much, but we get the chance to earn it doing something we can live with."

They were quiet. The only sound came from the distant chirping of Nela bugs echoing over the water. Lott studied Armitage for a few moments. He'd never seen his commander lose control like this, much less admit he was wrong about something. That alone almost augured the End of Days or at least a friendly Vanduul.

"We can't stash our ships on transports either. They'll think the metal's finished processing and the transports are there to move it." Lott turned back to the aurorae dancing in the sky. "But it's useless to speculate; we need someone on the ground to see exactly what we're dealing with."

Shen grinned. Armitage had slipped back into his usual stoic self, a little more assured now.

"Well, let's not keep the man waiting."

*   *   *

Harroway's Aurora bounced into the Garron system. It was barely armed and shielded, to the point where space debris could probably down it. Harroway sat at the controls, sweating.

As the post-jump haze cleared, Garron unfolded in front of him, looking very much the way he left it. Three planets and one dwarf planet circled the massive yellow-green sun. Garron I was a small mineral-rich but uninhabitable dwarf ball close to the sun. Garron II was formerly a lush emerald planet until the infamous Massacre. The UEE hadn't completed the terraforming, finding it inexpedient to finish the procedure or colonize it in any way, so they left it caught in a terraform-limbo. Beyond Garron II and a massive asteroid field orbited Garron III, home.

"Okay. What now?" Harroway glanced back to Lott who was sitting on the floor behind him with a system in his lap.

"Just do what you'd normally do," he replied.

"Are they watching?"

"I'm sure they are," Lott murmured, half paying attention. He finished powering up the system. "Let's see what we can see."

On top of the Aurora, a small mass-range scanner, hidden on the side of the ship, slowly searched through void.

Minutes passed without Lott saying a word. Harroway nervously tapped on the flight stick.

"Anything?"

"Not yet." Lott widened the acceptance ratio of the scan and searched again. The screen lit up from all sorts of energy signatures, including everything from solar wind to excess electromagnetic pulses coming off of planets. Lott combed through it all. He paused briefly. Mixed in the sea of signals, there was a focused anomaly. "There you are."

It was a ship, modified to minimize its energy output. Lott worked to separate its slight signature from the larger masses, then tagged and bounced it to the Aurora's onboard scanners.

Harroway stared at the small blip on his screen. It was well positioned near a cluster of asteroids with a clear line of sight to Garron III.

"The minerals on the asteroids must be hiding it from the scanners." Harroway almost sounded impressed. "How would common criminals know that?"

"People pick up tricks like that, doctor. Even pirates. They might not know why, but they know it works." Lott sent off a message to Armitage with the pirate's position and energy tag. "Just go for the planet. He's not going to mess with us."

"Are you sure?"

"He saw you leave. It'd be weirder if you didn't come back."

The Aurora's engines initiated burn. Lott watched the small blip on his screen as their ship passed the cluster of asteroids. The lookout's ship came into visual range. Lott tracked it with the scanner, watched it pass, then recede in the distance. Minutes later, the hull shivered slightly as Garron III's gravity took hold.

Lott was right; the pirate didn't move.

He was getting a good feel for criminal behavior.

*   *   *

The crack of a ship breaking atmo echoed across the barren landscape. Harroway could see the townspeople scatter during his initial approach. He circled wide around the refinery and settlement to give them a chance to recognize his ship.

By the time he touched down, most of the town gathered at the edge of the landing area. Shelly Cates, the closest thing to the town's mayor, stood at the front while the rest waited with weary yet hopeful expressions.

Harroway climbed out of the ship.

"Any luck?" Shelly yelled over the dimming engines. Harroway grinned and motioned back as Lott emerged from the Aurora. Murmurs washed over the townspeople.

"Hey," Lott greeted her as he dropped down onto the platform. His leg was killing him. Some shrapnel embedded in his thighbone always acted up when he shifted gravities. He hobbled around for a moment, hoping the movement would ease the pain.

Shelly looked at Harroway, unimpressed.

"That's it? One guy?" She glanced at Lott. "No offense."

Lott held his tongue. Fortunately, Harroway jumped in.

"There are two more, they are simply waiting for an approach strategy," Harroway said.

"So three . . ." Shelly couldn't finish. She looked down, frustrated.

"Hey, we can leave if it makes you feel better," Lott muttered. "You guys look like you could handle a dozen pirates, no problem."

"We might." Shelly wasn't backing down. "All they want is money. If it's just us, we take a hit but that's it. You start a war with them and lose, they'll come for blood."
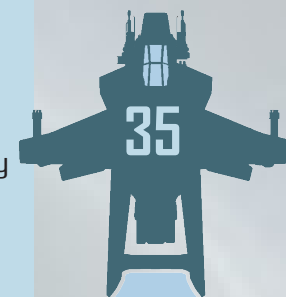
"We don't tend to lose," Lott replied with a shrug. In the past, he had used that line to assuage clients and it usually worked. But this time, he knew immediately how hollow it sounded. Shelly shook her head and stormed off. Lott looked over the faces in the crowd. Some seemed to be taking her ominous premonition to heart.

"I apologize for that," Harroway said. "Hardly the welcome you were anticipating, I imagine."

"I've had worse."

* * *

Armitage ran a final check over their supplies. All three ships had been tuned up, rearmed and recharged. He considered a minute, then loaded extra ammo and missiles into Lott's Cutlass.

Shen arrived at the launch bay. A delivery truck followed several moments later.

"How are we looking?" Armitage shut down the manifest on his MobiGlas and went to help Shen unload crates.

"Good, sir. I got some proximity mines, two crates of P4ARs with fifteen thousands rounds, but no luck on the mobile launchers," Shen said. "I put out a couple more calls. Just waiting to hear back."

Armitage considered it for a few moments.

"We can't wait. We'll make do."

"Yes, sir." Shen dutifully started loading the crates into the Cutlass.

"Shen, listen, I need a word."

"What's up, sir?" Shen stopped.

"It's about the pay for this job." Armitage hesitated. He really hated talking about money. "I'm gonna need you to take a hit on this job."

"What do you mean?"

"There's no money to pay us." Armitage just came out with it. Shen was blank at first then confused; perhaps he'd heard wrong.

"I thought Harroway was paying sixty thousand each."

"I told him sixty thousand total plus expenses. I know Lott's been having money problems and we can't do this without him. So I'm giving up my share for him and was hoping you would do the same."

Shen looked at him. Armitage kept going.

"These people are in jam and need help. I couldn't just tell them to drift because the price wasn't right." Armitage paused. "I'll make it up to you on the next job, kid. I swear."

Shen looked down. The landing deck dispatcher squawked over the loudspeaker, directing a pair of incoming ships.

"Fine." Shen wearily went back to loading the last of the crates in silence.

Within the hour, they broke atmo and headed into space. Shen took lead while Armitage towed Lott's Cutlass via Remote Tether. Armitage loaded Lott's newest intel into his and Shen's computers.

To stay off the lookout's scans, they would need to enter the system from a different jump point. That meant taking the long way around, a route straight through Vanduul space. But, if successful, they could keep Garron III between themselves and the lookout during their approach.

Shen reached the UEE Border checkpoint first. He passed along their ship-tags. By the time Armitage arrived, they were cleared to enter outlaw territory.

The UEE placed sensor buoys throughout the Virgil system to warn of impending Vanduul raids, but still hadn't been able to secure a stable occupation of any of the planets. Which led many to suspect that the UEE weren't the only ones with eyes on the system.
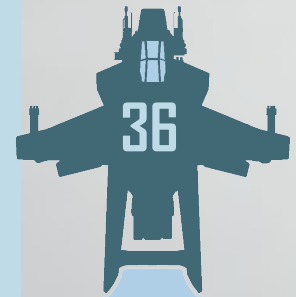
They passed a group of deep-space explorers making a push into Vanduul territory, but otherwise it was a clean run. There was only one more system between them and Garron, but it was a doozy.

To the Vanduul, this system was called Korathen. To the UEE, its official name was Tiber. The soldiers and pilots had another name for it: Grinder. Historically, it was a staging area for Vanduul raids into UEE territory. Before the current stalemate, dozens of clashes between the Navy and Vanduul clans sparked off in this system. Clashes that Armitage and the Seraphim had been a part of.

Grinder seemed quiet at the moment, but believing that was a dead pilot's first mistake. Shen flew point and maintained a steady course straight for the jump point into Garron. Armitage kept his scans wide and often. They hardly spoke; when they did it was for course adjustments.

The skeletal remains of older model UEE and Vanduul ships drifted through the black. After decades on the drift, the scavengers had all but picked them clean.

Armitage's scanners pinged. He quickly cued the comm.

"Quick quiet." He powered down his engines. Shen did too. They drifted forward as Armitage sifted through the scanner. Something was emitting a lot of energy out there, much more than a single ship would produce unless it had seriously overclocked its shields.

A gnawing fear ate at Armitage's gut. A fear that could be expressed in two words: Vanduul destroyer. But his initial reading didn't match what he knew of a Vanduul energy signature. He tried filter after filter to isolate the signature. There didn't seem to be any propulsion. Whatever it was, it was immobile. It looked like energy associated with base shields and life support.

"What is it?" Shen finally asked. That's when Armitage saw it.

"It's a platform." An old docking platform drifted among the detritus. If Armitage's scan range hadn't been so high, they would've flown right past it.

He turned his optics toward it and magnified. The platform was an old terraforming hub-station, a place for employees to live while they stripped and rebuilt worlds. From the ships docked along the side of it, it appeared the Scourge had taken it over.

"Have they seen us?"

"Doesn't seem like it." Armitage sent the platform's signature over to Shen. "Keep thrusters at twenty-percent and we should be good."

Now they knew where the Scourge slept.

*   *   *

Harroway showed Lott an old warehouse on the edge of the settlement that they could use to hide their ships in case the Scourge did any flyovers. He assigned one of his employees, Milson, and a few of the townspeople to help Lott clear it out.

They were nearly done when Armitage and Shen arrived. Lott grimaced as his Cutlass touched down. The landing gears strained as the remote piloting dropped the ship down too hard.

Shen was the first to drop to the deck.

"How'd it go?" Lott asked as he opened the cargo bay on his Cutlass. Shen just shook his head and silently started unloading.

Armitage came up moments later.

"Looks like the Scourge have set up shop in the Grinder." Armitage seemed chipper, like he was back in the Service. He stepped out of the warehouse and took a look over the town. "Get the gear unloaded. We'll have a defensive assessment in fifteen."

"Sir, yes, sir," Lott grumbled.

The three of them took a walking tour of the settlement. Of the sixteen buildings in the town, the refinery was by far the most defensible position. The walls were laser-cut stone. Only
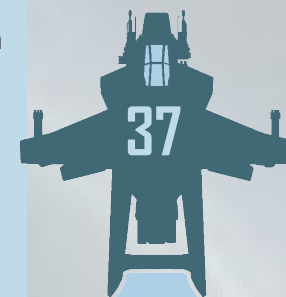
one door and one cargo bay in-or-out, and both were sealed with massive titanium bolt locks. There was a security system in place and a dedicated generator inside.

That was the one thing they could agree upon. The rest was a debate. Armitage argued that they should hide the towns-people in the refinery and seal it, while Lott countered that trapping everyone in one place, even a sturdy one, should be used as a last resort. Shen, used to being stuck in the middle of their fights, just kept quiet.

Hours passed as the argument continued throughout the town like some roving, shouting tumbleweed. Both sides gained and lost ground but eventually a rough sketch of a plan was formed. They met with Harroway and Shelly in one of the conference rooms of the refinery.

"Phase one, we thin their numbers," Armitage began. He brought up a map of Garron system onto the wallscreen. "One of us goes up and engages the lookout. We make sure he gets a call out to his friends, then down him. They won't all come out to fight a single ship, but they won't let it be a fair fight, so we're expecting two to four reinforcements. All three of us ambush and destroy the reinforcements."

"Surely that would spur the rest of the Scourge to action." Harroway seemed nervous.

"It's possible, but unlikely," Lott interjected. "Your timetable is the one thing that we've got going for us. They're here for the money, not loyalty to their friends. If they kill everyone before the refining is done, they don't get the money. So they'll wait."

"Was the timetable you gave the Scourge accurate?" Armitage asked.

"I'm sorry?"

"Did you lie to them about when the processing would be done?" Lott clarified.

"Oh, no." Harroway looked down. "I suppose that would've been a good idea. I've never had a gun pointed at me, you see . . ."

"It's all right." Armitage brought up a list of fortification tasks and available assets. "But that brings us to phase two. Defense. We shore up the town, train your people and prepare for invasion. Hopefully it won't come to that, but better be safe."

"Phase three activates when processing nears completion. Engagement. This will be somewhat fluid, as we'll have to see where the Scourge places their forces. In short though, we hit them first as far from here as is safe. The three of us will get overwhelmed quickly so we fall back incrementally to regroup and re-engage. Hopefully by keeping them moving, we can dictate the flow of combat, knock down their numbers and eventually destroy or rout them before they step foot on the planet."

Harroway and Shelly looked at each other. Their apprehension was obvious.

"If you think it will work," was all Harroway could muster.

* * *

Shen volunteered to hit the lookout. He took off at dusk. The Hornet skirted along the landscape before pulling up toward the sky.

Armitage and Lott prepped their ships. They were on standby until Shen could confirm that the lookout's call had gone out. Lott ran another system-wide diagnostic to kill time.

Across the warehouse, Armitage stared vacantly out his window. He felt drained. For the first time in his life, he felt his age. In that moment of realization, his whole life washed past him; all the battles, the close calls, the faces that never got the chance to age another day. Those memories engulfed him.

"Call's out," Shen suddenly reported over comms.

"On our way," Armitage replied. He tried to dispel the moment of melancholy that had seized him. Even as he launched, it was not so easily dispelled.
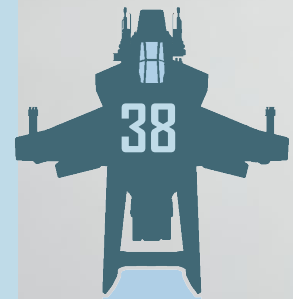
But he more or less felt back to normal by the time he cleared Garron III's atmo. Lott's Cutlass was backing him up. They grouped up with Shen. For the moment the scanners were clear.

"He give you any problem?" Lott asked.

"Nothing I couldn't handle." Shen's voice seemed calm, detached.

"Enough chatter. Let's get into position," Armitage snapped. Faint contacts appeared near the jump point to Grinder. He plotted out an ambush position in the asteroid field between Garron III and the reinforcements.

The three dispersed quickly. Armitage and Lott assumed opposite posts among the tumbling boulders, while Shen played the bait, left in the middle feigning engine problems. To keep their presence unknown, Lott and Armitage had to keep their shields down until they sprung their trap.

Lott watched his scanners. The blob of energy signatures raced toward them and separated into four patterns. He figured they'd catch one, maybe two in the initial assault. Probably a third before they realized what was happening. The last would be easy pickings.

Then Lott noticed something. One of the ships had already been tagged. His system already knew it.

It was the lookout. He instinctively cued the comm.

"Hold on . . ." he said, still trying to understand what was going on. It had to be a mistake. The computer was wrong.

Lott looked up as Shen's ship suddenly swiveled toward Armitage and opened fire. Without shields, he didn't stand a chance. Bullets and lasers punched through the hull while rockets pulverized the rest. In seconds, it was over and done.

Lott froze. It felt like the oxygen had vanished from his body.

"What . . ." Lott finally found his breath. "What did you do?"

The pirates surrounded Lott with heated guns. Shen's voice, still calm and detached, drifted across the void.

"You were right."

TO BE CONTINUED

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CHRONICLES