

SAGITTARIUS EYE

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ISSUE **27**

FLEET CARRIERS

HOW WILL THEY CHANGE
THE WAY WE FLY?

FEATURING: DATA-DRIVEN COMBAT • HUDSON'S REAL LEGACY
BUILDING THE PRINTWORKS • BUREAUCRAT SUPERPOWER
MISSION FARSIGHT • THE DEADLY TOUR • DASHBOARD DICTUMS
WANDERING WORLDS • STELLAR STREAMS • CO-PAWLOTS

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ISSUE 27

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EDITORIAL

Souvarine

As we've touched on before, the Pilots' Federation is a controversial organisation. Sometimes called 'the fourth superpower', it's a stateless association of privateers, unbound to any particular jurisdiction and enjoying inordinate privilege. As the only publication by and for Pilots' Federation members, we feel this tension keenly.



People tend to focus on the issues of wealth and power when discussing the Pilots' Federation. Privately-owned starships are portals to immense personal riches, it's true; and heavily-armed private warships are more than capable of turning the tide of wars over entire star systems, allowing unelected freelancers to decide the fates of millions.

But one privilege in particular goes relatively unnoticed. The Milky Way, for most of human history, was our backdrop — the easel against which we painted our lives, unchanging and unmoving. We had no more hope of exploring it than would characters in a novel of climbing out of their pages. No longer.

With a few decades of savings, it's possible to now buy a ship that can explore the whole of our galaxy, speck by speck. This isn't tourism (though of course that exists too) — this is private, unbidden travel throughout the furthest reaches of our entire galaxy. Most of the trillions of humans alive today will never have this ability, and those on settled worlds still gaze up at the Milky Way as little more than a skybox, as we always have.

This, to me, is the greatest privilege we have, and what we celebrate in this issue. We analyse the tumultuous environment of the galaxy's stellar streams, eddies in the maelstrom we call home. We go in hunt of 'rogue' planets. We catch up with famous Pilots' Federation member Commander Picard, the man behind Mission Farsight, on his fifth year out in the black. And we discover the greatest threats and deadliest star systems explorers can encounter.

Closer to home, we revisit the 'warrior-scientists' efforts to fight back the Thargoids in the Pleiades, and our perceptive analysts weigh up the events of last year in the context of the Federation's leadership this decade. We also look back at the construction of our very own Printworks, the asteroid in which I sit, writing to you now.

Our best issue ever? I think it might be. With love, from us to you. By commanders, for commanders — always.



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It is often suggested that the Alliance is plagued by unnecessary bureaucracy. Supposedly inefficient and with painfully slow decision-making, the Alliance's effectiveness arguably falls short of its potential. This, at least, is what populists like former President Gibson Kincaid would have us believe. This month, an Alliance observer assesses whether these claims have merit.



The bureaucrat superpower

Only the bureaucrats can see through the immensely complex treaty structures in place and keep things running.





The success of the Alliance of Independent Systems (AIS) in recent years is often attributed to the role of Prime Minister Edmund Mahon. Traditionally, prime ministers have struggled to remain in power for longer than even one term: the various cultures and interests represented in the Alliance Assembly make any sort of political project hard to accomplish. The Prime Minister's role — to accommodate the needs of the vastly different groups — probably makes his job one of the hardest out there.

Unlike the Federation and Empire, there is not much central authority in the AIS besides the Council of Admirals. While no superpower could exist without some degree of standardisation, the AIS is less centralised than the other super-

The AIS has long evolved into more than a military alliance.

powers: it is arguably best described as a trade and mutual defence agreement, founded in order to protect the independence of its members. While it has achieved that aim over the years, the AIS has long evolved into more than a military alliance.

As a common identity starts to form and new traditions emerge, the question of closer cooperation arises. Yet for many — especially newer members — ever-closer union is not necessarily what they had in mind when they signed up. More 'cooperation' can quickly become more 'centralisation' — and preservation of sovereignty is at the heart of AIS membership.

So far, the solution to this tension has been to come up with different treaties for different systems. For example some members may band together and adopt a joint cultural policy, whereas others may decline such offers in order to preserve what they consider to be their unique cultural values. The situation is similar for almost all policies that are not linked to defence or trade. Consequently different rules can be found in every single member state. Not for nothing is it said that the AIS is truly run by civil servants: only the bureaucrats can see through the immensely complex treaty structures in place and keep things running.

On a grander level it's the diplomats and negotiators — led by Mahon — who could be described as the closest thing the AIS has to a central government. In order to establish central laws, they need a majority of independent systems in the Assembly — something that rarely happens. Should a proposal not succeed, then the horse-trading starts.

Since the constitution limits the types of policy that can be set centrally, decisions made in the Assembly are often modest in scope. Consequently, the AIS often lacks clear political will. Accusations of inefficiency and calls for reforms have been the result. At their height, these played into former

President Kincaid's failed attempt to turn his largely ceremonial role into that of a strongman last year.

Conservatives see the AIS' lack of central policy-making as a strength rather than a weakness. It is arguably a good way of making sure that members remain truly independent and diverse, while also making it hard for anyone to accrue too much power. And, ultimately, the AIS does still excel at military and economic cooperation — as evinced by its rapid growth. A more centralised body would arguably have had to resort to conquest by force to expand as far and as fast as the Alliance has done in the last six years.

This perspective suggests that the way politicians like Kincaid obtain high office (apart from having competitors assassinated) is by harnessing voters' frustration over local issues — which still exist everywhere, of course. The devolved structure of the AIS means that local issues and local administrations are the foremost presence in citizens' lives. Not every local administration in a decentralised system of government runs as efficiently as might be achievable with strict central oversight, as is more the case in the other superpowers. A spectrum of quality in local government is arguably the price you pay for a decentralised society. But local governments are easier to repair than big, powerful central administrations. Once too much power has been directed to a central policy-making authority, it has historically been hard to decentralise again. This is a recurring phenomenon in human history, and one we could learn from.

The Alliance is certainly not a perfect model — but it's not obvious that it could have chosen a better one, given the circumstances of its founding. Despite criticism, it stands as a clear alternative to other societies across space — and looks like it's here to stay.



The bureaucrat superpower

Text: Ulon

Images: OrangePheonix, Zer0axis

Design: McNicholl



HUDSON'S REAL LEGACY:

the Scythe of Panem and the Scourge

On the 16th of December 3300, President Jasmina Halsey declared the narcotic Onionhead, grown on Panem in Kappa Fornacis, illegal. In the following days, the Federation fleet, under Admiral Vincent, used military force: initially carpet-bombing with incendiary weapons and later using glide munitions to spray into the atmosphere a biocide targeted to wipe out the newly-illegal plantations.

Nearly five years later, on the 6th of September 3305, Alliance Prime Minister Edmund Mahon addressed the crowds attending the closing ceremony of the Alliance Festival of Culture on Birmingham in Diso. He spoke of the fine art, the music and the theatre of the preceding seven weeks. The scale of the event was unprecedented. Spanning seven star systems in or close to Alliance space, the festival was designed to showcase the innovation, creativity and independence of thought that makes the Alliance so different from its elder and larger superpowers, the Federation and Empire, and to encourage the visionaries and innovators of the galaxy to make their homes in the liberal, forward-thinking worlds of the Alliance systems.

The logistics of staging such a huge multi-system event were staggering. The Alliance Tribune reporter, clearly impressed with the spectacle, reported some of the delicacies that had been laid on:

“City streets are lined with stalls offering a wide range of food. Dishes range from humble, home-cooked recipes using local speciality Diso Ma Corn, to delicacies such as baked greebles. Drinks connoisseurs have sampled everything from Ethgreze Tea Buds to Leestian Evil Juice, while a multi-storey cocktail bar sponsored by [the] distillers of Lavian Brandy has attracted revellers.”

The many millions of visitors to the seven systems created much higher demand for food and drink than the Alliance’s agricultural systems of Orerve and Orrere could satisfy, especially following a below-average harvest. Despite the increased demand, the festival organisers did not feel the need to call upon independent pilots to assist in procuring and delivering additional foodstuffs. The resulting food shortages, caused solely by a spike in demand coinciding with a relatively poor harvest, led to exaggerated news reports of impending famine. These unchallenged news reports continued the chain of

The Interstellar Association for Agriculture, by its indecision and its failure to act, had made the disaster far worse.

events started five years earlier that led to millions of lives being put at risk, caused a civil war, and brought one of the galaxy’s great corporations to its knees.

To the chemical giant Rockforth Corporation, the food shortages caused by the Alliance Festival of Culture must have seemed like a golden marketing and sales opportunity. Entirely coincidentally, it had been developing a new and highly potent synthetic fertiliser, codenamed EX7. On the 18th of September, less than two weeks after the Interstellar Association for Agriculture had issued a press release highlighting its concerns over maintaining the food supply, Rockforth Corporation took the decision to begin a public trial of EX7, by releasing small quantities onto the market at Marshall Dock in Riedquat. They also took the decision to sell the fertiliser at a price far below market value, which created a goldrush among distributors and independent traders, leading to a very wide distribution of the new fertiliser to almost every agricultural system within fifty light years of Riedquat.

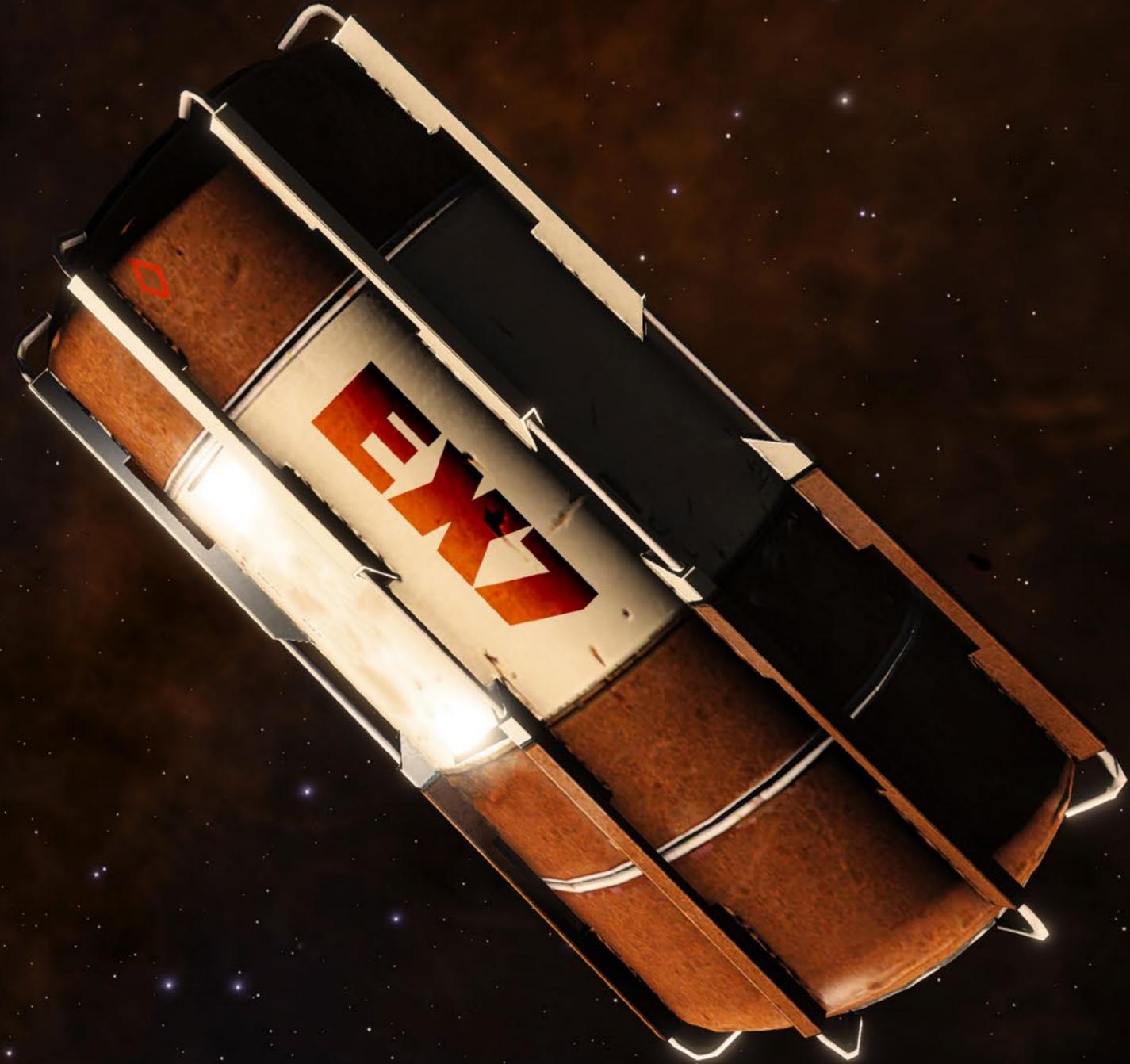
Rockforth had jumped the gun. Its new fertiliser had not been cleared for use by the Interstellar Association for Agriculture (IAA), and had not been subjected to the full range of controlled trials that would normally precede widespread distribution. The IAA did not intervene.

Despite the record-breaking sales figures, harvests continued to decline. By early October, Vox Galactica reported that continued panic-buying and stockpiling of fresh produce was further worsening the shortages. On the 11th of October there were reports of food riots on Birmingham and Simpson’s World, and the Galactic Welfare Trust put out a call to freight pilots to deliver emergency aid to the Diso and Orerve systems. The Interstellar Association for Agriculture started to see a pattern in the reports of harvest failures, different from the poor harvests of August and September. Crops that initially appeared healthy would wither and die within a matter of days, sometimes even within hours. This was happening simultaneously across many agricultural systems.

The Interstellar Association for Agriculture was once again slow to investigate, let alone take action. It wasn’t until Vandermeer Corporation stepped in to take charge of the investigation that clear evidence was found that linked the second and far more serious wave of crop failures to Rockforth Corporation’s EX7 fertiliser. The supposed cure for the first wave of food shortages had made matters far worse, bringing many systems to the point of famine.

Those same interstellar freighters that had so willingly distributed the EX7 fertiliser, and that had helped in the distribution of emergency food aid, were now instructed to head back out, to round up remaining stocks of EX7, and deliver them to Wiley Port in Teveri for incineration. The environmental impact of the entire exercise was huge.

At this point the whole sorry mess might understandably have been attributed to a combination of poor forward planning by a number of Alliance systems, coupled with a huge corporation selling a disastrously defective product without having completed the necessary regulatory steps. The Rockforth Corporation was clearly to blame for the famine, and the Interstellar Association for



Agriculture, by its indecision and its failure to act, had made the disaster far worse. But on the 20th of October, a significant discovery completely changed the course of the investigation — a discovery that linked back to the events of 3300 and early 3301.

Crime agencies from the three superpowers, working together with Vitadyne and Rockforth, identified traces of a synthetic contaminant in batches of the EX7 fertiliser. Gino Borstein of the Federal Intelligence Agency revealed that the contaminant had also been found in the Rockforth manufacturing facility. Investigation into the contaminant revealed that the synthetic compound

formed the vector to deliver a highly aggressive pathogen that could infect, desiccate and wither an entire planet's crops, with initial effects visible within twenty-four hours and total crop death within three days. The pathogen was persistent, and could continue to cause crop failure in subsequent plantings.

What evil, irrational individuals or group would want to cause famine throughout the heart of the inhabited Bubble, not just in Alliance space but also in many Federal and Imperial systems? What possible motivation could there be? Initial speculation was that a rival of Rockforth's might have been seeking to irretrievably de-

stroy the reputation of the Rockforth Corporation. But to find out who was really behind this blight, referred to popularly as 'the Scourge', we need to travel back to 3300 and the Onionhead plantations of Kappa Fornacis.

Onionhead is not native to the Kappa Fornacis system. It was discovered and catalogued in HIP 55118 many years ago, but its 'medicinal' properties were first discovered and exploited by the farmers of Panem as recently as the turn of the century. It proved a near-instant hit among young people in nearby systems, creating demand that outstripped supply by the end of the first growing season. Farmers and plantation owners across the planet

switched production from food crops. By closely controlling the supply of Onionhead plant clones, Kappa Fornacis was able to maintain a stranglehold on production, something that kept prices high while scarcity stoked demand.

The highly addictive, powerful narcotic effect of the paste derived from Onionhead seeds, which the distributors insisted was completely harmless, quickly drew the attention of then Federal President Jasmina Halsey. Within five days of the Federation declaring Onionhead illegal, a blockade had been imposed and the Federal Navy, under the command of Admiral Vincent, had started a firebombing campaign against the ripened fields of Onionhead. The Federal claim that their sophisticated weaponry ensured no collateral damage was disproved by images relayed from the planet's surface, showing families asphyxiated from smoke inhalation and terrified wildlife being burned alive. The navy continued the assault, switching to genetically-targeted biocides that it claimed would only wipe out the crop, not people, other plants or wildlife.

The military action ignited a political storm. Pro-Onionhead, anti-war protesters laid siege to Federal offices. President Halsey denied having authorised the attacks, asserting that Admiral Vincent had acted without authority. Shadow President Zachary Hudson, who was a close personal friend of Admiral Vincent, attacked Halsey's lack of a coherent policy. Halsey's position as President had never been weaker.

The military campaign continued. On the 17th of January 3301, Admiral Vincent declared that Onionhead had effectively been eliminated and started a campaign of civic aid, helping to rebuild the economy of Kappa Fornacis. The Federation's actions had only served to spread the cultivation of Onionhead to other systems, with many of the farmers shifting production to Luca in the Tanmark system. Georgio Algeria of the Panem Farmers' Union rejected Federation aid:

"We did OK from Onionhead. Here and on Luca. We're here to stay. Keep your stinking aid. Be happy. Onionhead helps!"

Zachary Hudson and the Republican Party continued to needle Halsey on the seemingly unstoppable rise of the various strains of Onionhead. It was the sudden, entirely unexpected disappearance of Jasmina Halsey on Starship One on the 26th of May 3301, and the subsequent appointment of Hudson as the replacement Federal President, that brought an equally sudden end to the war on Onionhead. Under Hudson, Onionhead remains illegal but the President seems to have tacitly accepted its widespread use in Federal space. It seems that Hudson didn't really care about Onionhead after all.

It seems that Hudson didn't really care about Onionhead after all.

Halsey's escape capsule was eventually found. She emigrated to Alioth, eventually to become an adviser to Prime Minister Edmund Mahon.

Peace, of a sort, seemed to have been re-established. But the farmers of Panem have long memories, and they seem to have been nursing a grudge. Using the remnants of the biocides that Admiral Vincent had used against their crops, a militant Onionhead farmers' organisation known as the 'Scythe of Panem' developed a variant non-specific biocide of a virulence never before seen; one that, once applied, would kill any crop it touched, then remain in the soil and cause repeated crop failures. It was this biocide that was used to contaminate the EX7 fertiliser, and that caused the Scourge.

Federal Intelligence Agent Gino Borstein questioned captured members of the Scythe, establishing that their motivation was revenge and their intention was to disrupt the galactic economy, as part of their manifesto, 'Crops for Crops'. He also established the location of the militants, in the Quator system, and with help from commanders of the Pilots' Federation and a lot of luck, he managed to completely eliminate the terrorists. The Rockforth Corporation and the Interstellar Association for Agriculture, without whose greed and incompetence the blight would have been unable to spread, did to some extent make amends by developing and distributing an agronomic counteragent that was able to control the worst effects of the crop disease. They did this in record time, and despite considerable risk of creating further disruption. Unfortunately, the counteragent could never completely eliminate the blight, which continues to flare up unpredictably — and if not treated promptly, can lead to recurring crop failure.

To recap. In 3300, in order to destabilise his political rival, Zachary Hudson arranged for the Onionhead fields of Panem to be destroyed by his friend, Federal Admiral Vincent. This was the first step in a chain of events that led to the establishment of a terrorist group, failed harvests on hundreds of worlds, food shortages, a war in Quator, and the release of a virus that leaves the galaxy's food supply permanently at risk. The Scourge is a terrible consequence of Zachary Hudson's underhand scheming that will outlast President Hudson himself.

Hudson's real legacy: the Scythe of Panem and the Scourge

Text: Peter Wotherspoon

Images: OrangePheonix, McNicholl

Design: McNicholl



THE DEADLY TOUR

THE STAR SYSTEMS THAT KILL THE MOST EXPLORERS

Exploration is dangerous. Planets flatten you, neutron stars cook you, and running out of fuel is a constant concern. But some systems are more dangerous than others. This month, we find out which are the deadliest systems of them all...

Imagine the scene. You're some thousands of light years out, with nobody other than your expedition mates. Far away from the turmoil of the Bubble, with neither human nor Thargoid to be seen, you feel safe and secure as you set up to land for the night. The spectacular ringed planet ahead, the surface a mottled crimson and magenta and its rings arching majestically over the horizon, greets you as your next landing site. You've already got a photogenic geological site selected, and you think about the images you're going to excitedly share with the expedition, and the rare materials you'll be able to gather.

Insulated in supercruise, though, you've not read the G-meter — nor have you thought of the implications of the fact that this planet needed nine probes to fully map out rather than the usual two or three...

You slip out of supercruise glide, boost to make the last few kilometres go by a bit quicker, and then you start to feel it. Four G. You feel very heavy. The ground is coming up very quickly, and nothing you do on the controls seems to be slowing this down. A feeling of panic starts to grip you as you realise you should have listened to Cmdr Sanderling's advice after all, and you spend your last few seconds desperately trying to remember what that was. The last thing you remember is the ground coming up to smite you, like a giant custard pie to the face, only rather harder and a lot more deadly...

Exploration, as it turns out, isn't quite as safe as people tend to assume. Certain systems turn out to be deadlier than others, and for a variety of reasons.

Natural hazards

High-G worlds are a frequent trap for explorers. They aren't the only natural hazard that the explorer may encounter, but are one of the most common. Take for example the star system HD 148937, some 1,400 light years from Sol. Its third planet is a

tourist spot advertised as "Strong G", being one of the highest gravity planets on which our ships can land using current technology. The unwary, seeing a lucrative tourism contract, will travel out here, maybe not thinking too much about this planet's 9.78G until they slip out of supercruise glide. This planet has claimed 252 victims, according to EDSM (a popular explorer's star map). It has likely claimed many more. It takes careful technique to land here, and it's vital that visitors learn this before travelling. Unfortunately many don't, and come to regret it as the surface of Strong G gains yet another small, sad crater.

A rather lower G planet, which would otherwise be unremarkable if it were not for its spectacular vistas, has claimed numerous victims too. The planet HR 6164 ABC 1 — better known as 'The View' — at a distance of 1,400 light years from Sol proves to be a popular spot for tourists and novice explorers. It was also one of the suggested waypoints during the Distant Worlds 2 expedition, which undoubtedly boosted its kill count. Those wishing to take in the views from the tourist spot need to take care. While it's far from Strong G's near 10G, the planet still has a reputation for gobbling up ships with its 3.3G. EDSM records a total of 118 victims, and the planet still requires careful landing technique if you are not to become its next victim.

High-G planets aren't the only hazard that explorers face. The exploration community is of course well aware of the dangers posed by neutron star and white dwarf jet cones, the latter being particularly hazardous. These jet cones don't extend far past the white dwarf's exclusion zone, so there's a higher risk of accidentally dropping from supercruise whilst in the cone — a terrifying experience few have survived. Due to the sheer number of these stars, few of them will have individually accumulated a significant number of kills. There is, however, one notable exception.

“With no suitable neutron star on the other side, there is no return.”

Spoihae XE-X d2-9 is rather better known by its French name 'Monde de la Mort', or 'World of Death'. At 21,800 light years from Sol, it tends to be a point of interest only for the more experienced explorer and receives significantly less traffic than The View or Strong G. The deadly planet in question is a small and unassuming metal-rich world with a periapsis that is terrifyingly close to its host white dwarf. Its highly elliptical orbit — taking just an hour — is 2.5 light seconds from the star at its furthest point, and just 60 light milliseconds (or around 18 megameters, eighteen times the normal drop-out distance for a space station) at its closest. This takes the planet well inside the supercruise exclusion limit for ships. To land on this planet, you have a small time window to enter orbital cruise (during which time, you'll likely be contending with damagingly high heat levels, just to make things more exciting). The planet will pass through the jet cone during its orbit, which will result in ship destruction if the ship is on the surface when this happens. The unusual nature of this orbit attracts explorers like moths to a lamp; so far Monde de la Mort has claimed 154 known victims and will doubtless claim many more over the coming years.

Murder most vile

Many explorers head out into deep space to avoid the madness of the Bubble — in particular, the violence. The hundreds of victims claimed by natural hazards pale into insignificance compared to the vast numbers claimed by both human and Thargoid violence. Explorers head off into deep space, with jump ranges maximised, hull strengths and shields minimised, not expecting to run into trouble along the way. On larger expeditions, there may even be a security detail to deter any wayward commander from turning on a colleague.

The largest expedition in history, Distant Worlds 2, set off from Pal-laeni in 3305 complete with such a security detail, lulling many into a

false sense of security. Its ambitious timeline included resource gathering to provide explorers with a new base of operations near Sagittarius A* — a mission that was ultimately successful — and to visit Beagle Point and Semotus Beacon, the latter being the furthest reachable star some 65,000 light years from Sol. The first major waypoint was Omega Sector VE-Q b5-15, better known as the Omega Mining Operation. This was to be the base of operations for the gathering of the raw materials required to build Explorer's Anchorage, the starport to be positioned near the galactic centre.

Unfortunately, trouble from the Bubble followed. At only 5,500 light years from Sol, and on the Colonia Connection Highway, the 'ne'er do wells' from the Bubble had little holding them back from bringing along highly engineered combat ships to cause mayhem. A total of 691 victims have been recorded in this system by EDSM, the vast majority being victims of the 75 highly-engineered combat ships from the lawless 'Distant Ganks 2' group. Fortunately for the victims, the Remlok Ride of Shame was short; the Omega Mining Operation asteroid base was on hand to receive them, and provide them with their inevitable and unwelcome insurance bill.

Those causing the mayhem had rather easy targets: poorly shielded exploration/mining ships with underpowered thrusters, that just couldn't get away once interdicted. Meanwhile, the killers boasted their accomplishments from the proverbial rooftops, and some continued to follow the expedition. Their own figures suggest over 3,000 kills by the time the expedition reached Sagittarius A*, and we have no reason to doubt the veracity of this figure.

Space madness

Some commanders have a very high level of commitment; so strong that they will venture out all the way to Beagle Point and Semotus Beacon. It has become somewhat of a rite of

passage for the more experienced explorer, and commanders will earn an attractive badge from the EDSM for making the journey. Those on the Distant Worlds expedition earned the right to display the expedition's logo on their ship if they arrived safely at Beagle Point.

Even on a large expedition, staring out into the intergalactic void from either of these points can overwhelm the explorer with a feeling of loneliness. Many commanders are already beginning to suffer from the condition colloquially known as 'space madness' by this point, and are no longer behaving entirely rationally. The journey back to inhabited space is long, with even Colonia being tens of thousands of light years away, and there is the need to pick a route through the now very sparse star field to return to something that looks like normal travel. When commanders look at the right hand holopanel, the self destruct button takes on a strangely irresistible attraction. Press the button and within one minute, the commander will be released from their torment...

Beagle Point itself is an unremarkable system: none of the landable planets are high-G, nor do they have any notable natural hazards. Yet the system has claimed 87 known victims, and almost certainly many more not known to the EDSM. Semotus Beacon (Oevasy SG-Y d0 — the brevity of the name giving a hint of the remoteness of the system) has claimed a further 25 known victims while being similarly devoid of natural hazards. It is likely that the majority of these will be commanders who can no longer stomach the idea of the void in which they have put themselves, and have taken the release of the self-destruct button.



“Spoihaae XE-X d2-9 is rather better known by its French name 'Monde de la Mort', or 'World of Death'.

Other similarly remote systems do not accrue victims, possibly due to only the most highly trained explorers paying these systems a visit: neither the Eastern Meridian (Plae Eur IC-D d12-0) nor the Western Meridian (Cyuefoo LC-D d12-0) have claimed any victims. These systems, located in very sparse parts of the galaxy, both give the same sense of remoteness that you will find at Semotus Beacon.

The trap

Frame shift technology has continued to develop since its release, first with frame shift drive (FSD) injection (the ability to inject certain elements into the FSD, colloquially known as 'jumponium', which can as much as double the range of a single jump), and then supercharging the FSD in the jet cones of neutron stars and white dwarfs. While jet cone supercharging is — in contrast to jumponium injection — a hazardous operation, a neutron star jet cone boost can multiply the ship's range by a factor of four, and can be reliably and safely executed by any well-trained commander.

Besides the physical dangers of neutron boosting, there is one other: a ship can strand itself in a region of space that it cannot escape from. For a ship with a high jump range, such one-way neutron jumps tend to be on the edges of the galaxy; but for ships with shorter jump ranges, it's possible to get trapped in some unexpected places too.

The most famous of these traps is HD 76133 in the M67 star cluster, which is better known by the moniker 'Anaconda's Graveyard'. It was the final destination of the 3303 Distant Stars expedition, not long after frame shift drives received the ability to supercharge in jet cones. At just over 3,000 light years from Sol, this was not a long-distance expedition in the normal sense, but in another: the route into the M67 cluster was one way. The route is known as the Cancri Climb, and it terminates with a neutron-boosted jump of just under

220LY. With no suitable neutron star on the other side, there is no return. At the time — before the availability of the Guardian frame shift drive booster — the only ship that could make this jump was a stripped-down Anaconda. At the end of the Distant Stars expedition, the entire expedition scuttled their ships on the third moon of the first planet. EDSM records the destruction of 46 ships in this system.

However, current events may put an end to these traps: Brewer Corporation has announced the availability of the Drake-class carrier, available to the richest members of the Pilots' Federation. These ships will have a single jump range of 500 light years, which exceeds even the largest neutron-boosted range of the most stripped down Anaconda by a significant margin. Undoubtedly a cadre of commanders will form a long-distance rescue service in the same vein as the Fuel Rats and the Hull Seals.

So what's an explorer to do?

Don't despair; there are things we can do as explorers to not fall victim to too many of these. Avoiding one-way traps is just a matter of careful planning. Avoiding being killed by another commander or a high-G planet is just a matter of having an exploration ship that doesn't have a paper-thin hull and decorative shields; with Farseer's engineering to the FSD plus a Guardian frame shift drive booster, even an Imperial Cutter with prismatic shields and shield boosters (not noted for having a great hyperspace range) can outjump the most paper-thin Anaconda of even a few years ago. The kind of builds suggested in SAGI's article in Issue 26 ('Surviving a Community Goal') will work well for exploration in these frame shift boosted times, while providing protection from hard landings and malice alike.

Saving yourself from space madness, however, is a rather more difficult nut to crack. This author suggests exploring in a well-appointed Imperial Cutter, as basking is a sure-fire way of keeping the madness at bay. 



EDSM records a total of 118 victims, and the planet still requires careful landing technique if you are not to become its next victim

The deadly tour: the star systems that kill the most explorers

Text: Mack Winston

Images: OrangePheonix

Design: Donald Duck

Thanks to: EDSM



FROM CLOSET TO ASTEROID:

BUILDING THE PRINTWORKS

The clacking of typewriters rings out through the station. Ships fly in and out of the mail slot, entering and leaving the hangars to deliver pristine rolls of paper or collect crates of freshly-printed magazines. Within the offices, the commotion of the dock is muffled by the chattering of the journalists, putting together the various media through which news and entertainment are conveyed to the galaxy.

The Printworks is a bustling news station built specifically to house *Sagittarius Eye's* offices, but it hasn't always been here. How did this lively asteroid base come to be built, and where were the team based before moving in?



Sagittarius Eye started out in September 3303 as a small news crew working to make a magazine. The crew of Issue 1 was tiny — credited in that issue as 16 strong, only a few of which actively contributed. The office space needed for the team was minimal, and so for many months the tiny team worked out of a closet space in Lave Station. It was in this modest setting that the team grew, and new formats were introduced in the forms of videos and a breaking news service.

During this time of growth the operation also struck up a partnership with the SPVFA (Stellar Photography and Video Fan Art) group of interstellar photographers and videographers, who quickly became the team's core image and video partners. The two outfits have maintained very close links to this day.

Things went well until the 29th of August, 3304, when a

terrorist attack was perpetrated against the offices by a group known as Alchemy Den. Their aim was disruption rather than destruction, in order to get the attention of the galactic superpowers and make the point that their politicking was getting humanity nowhere in the fight against the Thargoids. Sadly, laudable though the protestors' aims may have been, the *Sagittarius Eye* offices were completely destroyed. One reporter, Commander Rasudin, was in the print room at the time and tragically couldn't be saved by Lave Station's emergency services, despite their best efforts.

From this point on, *Sagittarius Eye* was based in the *Monocle*, a Lakon Type-10 Defender on loan from our partners in the SPVFA until a new base of operations could be established. A mobile transmitting station was set up to allow for the ship to be on the move at all times, and a printing press was built in its cargo hold. This was

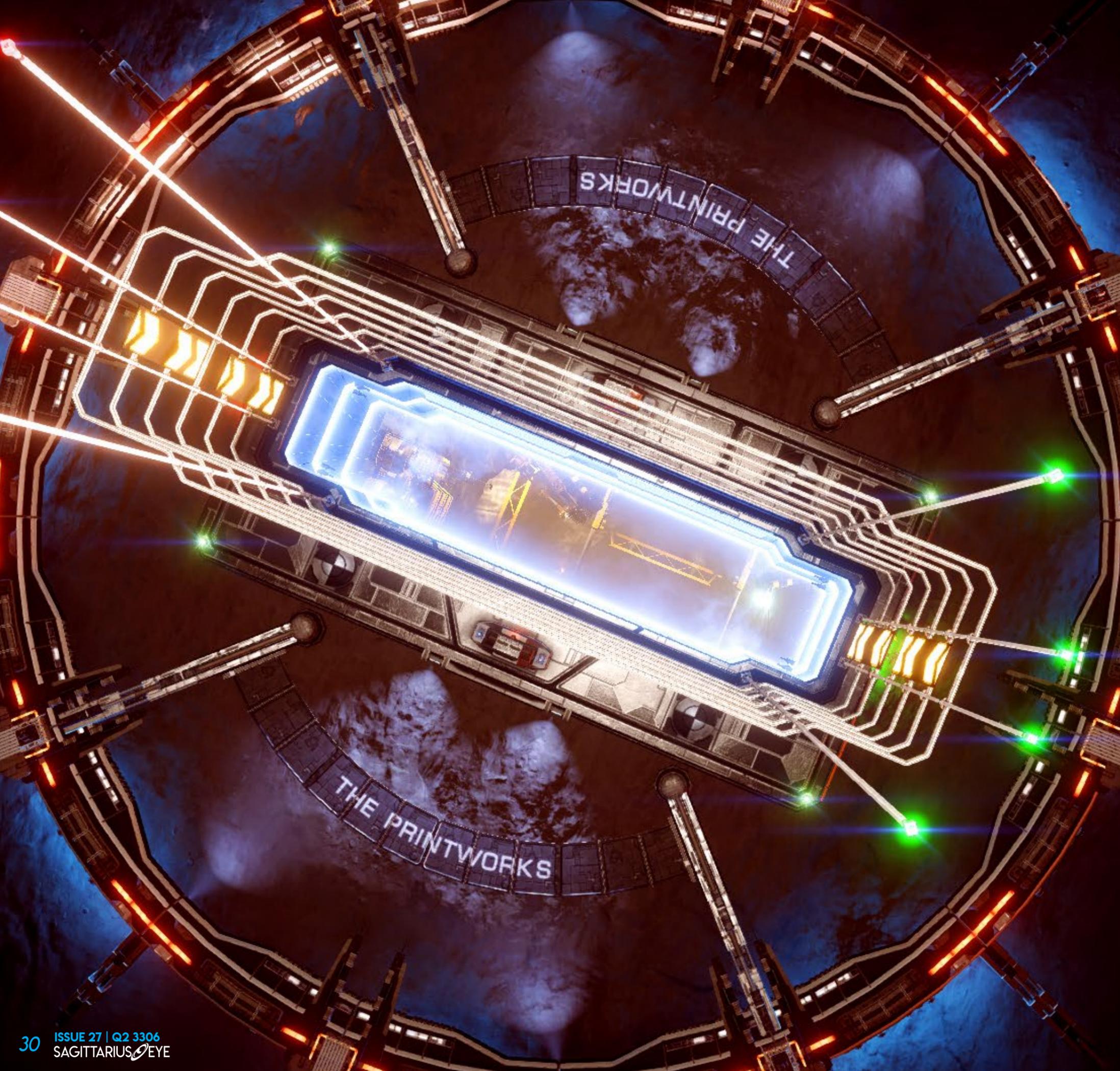
a time of constrained circumstances for the team, who knew that a more permanent base was necessary.

The *Monocle* served as our home for almost a year while SAGI management formulated a plan. The first phase was set into motion on the 19th of January, 3305, with the announcement of a Sagittarius Eye faction being established in the Millese system, chosen for its centrality, high-tech economy, and political neutrality. A suite of offices was rented in the Coriolis station McMullen Ring.

Shortly afterwards, and in a remarkable turn of events, the team of journalists were elected as the new government of not just McMullen Ring but the whole Millese system. Observers at the time were surprised that a team of feckless hacks could trounce an established and proven political outfit, and rumours swirled of cargo holds full of tonnes of spurious poll data being shuttled around

Phase two began on the 6th of June, 3305, when a new Community Goal was announced for the hollowing-out and construction of a new asteroid base.

local star systems. However, the transfer of government took place smoothly, and the Sagittarius Eye Operations Division got down to the business of government while the second phase of the team's plan was in the works.



Phase two began on the 6th of June, 3305, when a new Community Goal was announced for the hollowing-out and construction of a new asteroid base for the *Sagittarius Eye* team. Commanders from all over the galaxy were eager to chip in and haul materials to Millese. In one of the year's most supported community endeavors, the appeal finished at Tier 6 – and The Printworks was formally opened shortly afterwards.

The initiative was also supported by the community in other ways. Commander Kron Twelve of the Southern Cross High Guard donated over 10,000 tonnes of material towards the construction utilising their Type-9, the *Meandering Moa*. In a message to the *Sagittarius Eye* team, they said:

"A tradition in the building industry down under is for there to be a shout when the roof goes on. In the spirit of mateship the commanders of the Southern Cross High Guard donated twenty-four tonnes of Kongga Ale for the workers, not long after the new Printworks started construction. Said beverages were delivered on the 14th of June, 3305. Having made sure it got to the fellows and fellowesses doing the real work, this delivery did not come to the attention of management. Or perhaps it did, given some of the wonky construction observed the following day."

Since then, The Printworks has been the permanent office base of *Sagittarius Eye*, housing the magazine production division, printing presses, breaking news service, video creation and podcast studios, and administrative offices. The station was the start and finish line for the racing event Hot Off The Press, a journalism-themed time trial organised in collaboration with the Buckyball Racing Club. The Printworks also houses the *Sagittarius Eye* operations division, whose job it is to ensure that the Millese system and its environs are governed well.

Millese, just a mere 61.5 light years away from Earth and 49.8 light years from Shinrarta Dezhra, is a great stop for tourists wishing to see behind the scenes of a media outlet run entirely by commanders, for commanders – or for those simply wishing to stop by for a fresh copy of one of our latest issues. The system, and its asteroid base, are now a symbol of independent journalism in a dangerous galaxy.

*From closet to asteroid:
building The Printworks*

Text: Icarus Maru

Images: OrangePheonix

Design: LexMoloch



FLEET CARRIERS:

HOW WILL THEY CHANGE THE WAY WE FLY?



On October 7th 3303, the Pilots' Federation made an exciting announcement. They revealed that they were developing a new civilian vessel, and that it would be bigger than any yet purchasable by civilians. Fleet Carriers would be able to carry an entire squadron of ships and would be available to non-military customers by the end of 3304.

They're now finally here. What will these titanic vessels mean for independent pilots?

In the years since the ships were first conceived, their planned implementation has changed several times. Initially planned for ownership only by squadrons of pilots, it was later decided that they should be purchasable by individuals, albeit particularly wealthy ones — the ultimate acquisition for an interstellar trade magnate. Recent interviews with Pilots' Federation authorities have revealed a clearer picture of these private megaships and their capabilities.

In essence, Fleet Carriers are capital ships, of a similar scale and design to many of the other models commonly seen around the Bubble. Their frame shift drives operate on a similar principle; anyone who has seen one jump will be reminded of the dramatic, lightning-seamed entrance of a Farragut-class battlecruiser or Majestic Imperial Interdictor. Most of the hull is given over to hangars for starships, with room for administrative offices and crew quarters towards the bow.

From the visiting pilot's perspective, Fleet Carriers will operate similarly to starports. The number of services on offer will depend on what the Carrier's owner has seen fit to equip it with, but many of the common starport services will have recognisable counterparts on board. However, unlike most starports, fleet carriers are mobile — making them an unprecedented tool for group action.

Fleet Carriers can jump up to 500 light years at a time, and can be equipped with repair, refuel and rearm facilities, multiple ship storage, bounty and combat bond redemption services, a commodity market and storage, a Universal Cartographics terminal, and ship outfitting. As such, alien-hunters will be able to load up into one to rapidly deploy to the Thargoid war zones in the Pleiades, allowing ships with short jump ranges and lacking fuel scoops to get out into the fray in a fraction of the time that travelling there alone would take. Groups of mining vessels will be able to dock and visit a newly-discovered pristine reserve en masse, with a ready market for their

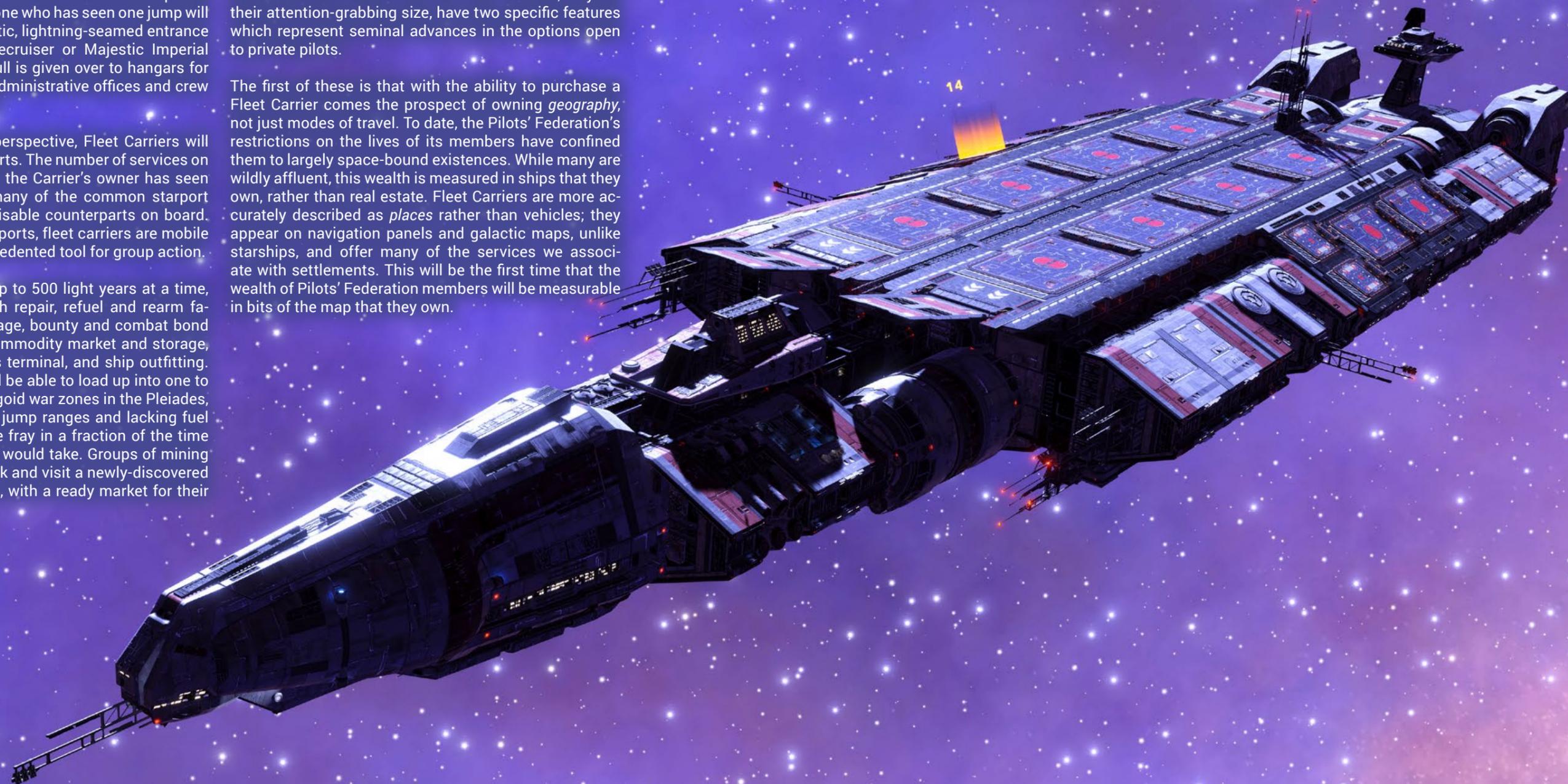
haul close by. Wings of heavy fighters will be able to deploy as one to conflict zones around the Bubble — all with the support of a reasonably-equipped starport in close proximity.

As such, Fleet Carriers represent a new paradigm in how members of the Pilots' Federation will be able to coordinate and support activity together, within the Bubble and further afield. They will greatly increase the options open to ships less suited to distance travel, and act as nexus points for pilots pursuing similar aims.

Observers have noted that the new vessels, beyond their attention-grabbing size, have two specific features which represent seminal advances in the options open to private pilots.

The first of these is that with the ability to purchase a Fleet Carrier comes the prospect of owning *geography*, not just modes of travel. To date, the Pilots' Federation's restrictions on the lives of its members have confined them to largely space-bound existences. While many are wildly affluent, this wealth is measured in ships that they own, rather than real estate. Fleet Carriers are more accurately described as *places* rather than vehicles; they appear on navigation panels and galactic maps, unlike starships, and offer many of the services we associate with settlements. This will be the first time that the wealth of Pilots' Federation members will be measurable in bits of the map that they own.

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The Pilots' Federation have emphasised that the ships are most certainly not for everyone.

The second is the Fleet Carriers' commodity market, which allows owners to buy and sell commodities directly to other Pilots' Federation members, at prices they themselves set. Pilot-to-pilot commerce has historically been strictly regulated; the Pilots' Federation has always encouraged its members to primarily trade with starports, recognising that, as an organisation, much of their unique and privileged status derives from their essential function in moving goods from where they are made to where they are needed. While it remains to be seen how revolutionary this step is (it's unclear what a pilot might want with 64 tonnes of Atmospheric Processors, for example) it is already clear that this will make the business of transferring large sums of credits between independent pilots much easier than in the past.

Despite the excitement, there has been significant controversy surrounding Fleet Carriers. As well as the usual voices decrying any extension to the inordinate privileges private starship pilots already enjoy, more sober voices have pointed out limitations in the ships' design and operation.

With a showroom price of 5 billion credits, a personal Fleet Carrier is no small purchase. When this figure was first announced it garnered amazement, bemusement and ridicule — with many observers pointing out just how long it would take a casual pilot to accrue the money necessary to buy one. The Pilots' Federation have emphasised that the ships are most certainly not for everyone, and are aimed squarely at their most wealthy and experienced members.

However, the price tag was soon forgotten when it became clear just how expensive Fleet Carriers would initially be to run. As a joint project between the Pilots' Federation and Brewer Corporation, the cost involved was always at risk of inflation. The Pilots' Federation represents a ready market of acquisitive billionaires, and it's unsurprising that Brewer priced the Fleet Carriers' add-ons with stratospheric ongoing costs.

According to the first deal struck between the Pilots' Federation and Brewer, the ongoing costs for running a fully-equipped Fleet Carrier would have run to nearly 150 million credits *per week*. This would have made their small crew of technicians some of the most highly-paid professionals in the Bubble, despite their curtailed responsibilities (they are unable, for instance, to move tritium from the cargo bay to the fuel depot in the owner's absence).

Darker accusations of price gouging were in the air. Why, demanded prospective purchasers, does Brewer persist with the name 'Fleet Carrier' when the flagship feature (the ability to store one's fleet) was an expensive add-on and not included as standard?



Regardless, most analysts agreed that the running costs of the new vessels at best represented a spectacular failure of negotiation on the part of the Pilots' Federation, and predatory pricing from Brewer and Carrier Services at worst. The latter are said to be heavily unionised, fiercely resisting any increase in responsibility or diminution in pay.

It was not just the running costs that raised eyebrows. Drake-class Fleet Carriers were initially built to have a spool-up time of no less than one hour for each hyperspace jump — presumably to allow their pampered crew plenty of time to finish their lunch breaks. This was a sharp contrast to the near-instantaneous jumps managed by military capital ships, who seem able to deploy to war zones at short notice and leave them within seconds of deciding to retreat. Each jump had a cooldown of a full hour as well, putting the Carriers' total speed at a measly 250 light years per hour — comparable to a stock Eagle.

So, with many potential purchasers questioning the value of ownership, Brewer and the Pilots' Federation

recognised that they had some way to go to convince pilots to open their wallets. With a release date set for June, the negotiations with the Carrier Services lobby and Brewer themselves were reopened. Both sides saw that changes would be of crucial importance in determining the long-term viability and value of these gargantuan craft, and in mid April, the Pilots' Federation announced that a new agreement had been reached.

Following talks with Brewer Corporation, it had been decided that the safety parameters around the ships' frame shift drives were perhaps unhelpfully stringent, and that the spool-up time could be safely reduced to fifteen minutes. What's more, the hour-long cooldown time was discovered to be the result of overcaution in estimates from Brewer's suppliers, and that the drives could be spooled up without undue risk a mere five minutes after completing a jump. These reductions in times completely changed the equation, increasing the Carriers' effective speed sixfold.

What's more, the Pilots' Federation had managed to gain concessions from the powerful Carrier Services union,

The Pilots' Federation have emphasised that the ships are most certainly not for everyone.

greatly reducing the staffing costs for the ships. While this didn't exactly put them in reach of more pilots (they are still stratospherically expensive) it did change the equation for most rich potential owners, making them a more appealing proposition.

Pilots' Federation members are already planning what they'll do with their carriers. The Deep Space Support Array is an initiative to place at least one Carrier in every sector of the Milky Way, dramatically increasing the number of rest and repair stops available to explorers. Racers plan to deploy them in orbit around particularly good track sites, such as Achelous 8A, to act as repair

stations — and to allow them to take short-range racing ships far beyond the frontier to make use of remote race tracks like Labirinto.

"I'm gonna try a little arbitrage and coordinated mining," said Commander Kai Zen. "I can buy agronomic treatments and take them to blight worlds, or expensive medicine to systems in outbreak. Or just buy up low-temperature diamonds on shit market days and wait one or two days — there are times when the best price is 1.0 [times galactic average] and others where it's 1.5. That's a huge swing for a day's wait."

The core premise of Fleet Carriers is solid. A deployable home for your fleet, with many of the conveniences of a starport, is a powerful proposition — and many Pilots' Federation members have long campaigned for something big to spend their billions on. It seems they finally have it.



*Fleet Carriers:
how will they change the way we fly?*

Text: Souvarine

Images: Zer0axis

Design: LexMoloch

dashboard dictums



Not much of a story to it but I add an aloe plant to every ship I decide to permanently add to my fleet. I saved every penny of my life to get into the Pilots' Federation. As the aloe is the only human plant, it reminds me of the greenhouses on Dromi where I grew up.

- *Aloneinthewasteland*

Everyone loves to customise the spaces they spend their time in and the places they call their own. Whether it's by sticking a photograph of a favourite holo-vid starlet to your locker at work, hanging a pair of furry Schrödinger Cubes from the rear view-screen of your hoverbike, or simply using your favourite *Sagittarius Eye* magazine cover as the background image on your data tablet, it's a natural animal instinct to want to put your mark on something and say "this is me".

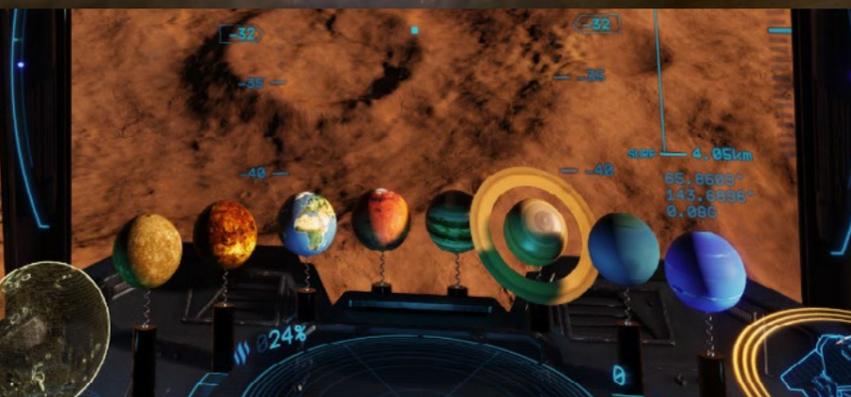
And so, nearly a year and a half after we examined the ways in which commanders chose to name their ships in Issue 17, we now turn our attention to cockpit customisation.





On the dashboard, my explorer ships have 'SHIELDS' to remind me to turn them back on, my combat ships generally have 'FROSTY' to help me stay that way, or sometimes 'BOOM' or 'HEADSHOT'. My Imperial ships of course say 'BASK' and my Dolphin says 'SQUEEE!'

- Ky Vatta



First introduced to our ships back in September 3301, the 'bobblehead' is now a familiar sight on many a pilot's dashboard. In fact, the idea of the bobblehead can be traced back as far as 17th century Asia, when 'temple nodders' were produced to represent Buddha and other religious figures. However, the more classic design of a figurine sporting an oversized head, spring-mounted to wobble comedically on its body, was actually popularised in America (birthplace of the Federation) in the 1960s, when they were used to represent well-known baseball players and popular recording artists of the time, such as the Beatles.

We now have over forty different types of customisation that we can place in ten standard slots built into the dashboards of our ships, as well as a variety of string lighting options. These customisations include some classic bobblehead figurines, assorted notable pot plants, the eight major planets of the Sol system, various ship and space station representations, plus a range of seasonal adornments including Christmas trees, Halloween skulls, and pumpkins. More interestingly, there are two complete sets of alpha-numeric characters which provide the creative commander with all sorts of intriguing possibilities. In addition to these items – which can all be purchased using ARX – there are also a range of bronze, silver and gold Squadron leaderboard trophies, celebrating quarterly victories in everything from exploration to anti-xeno combat. And lastly, for the truly committed Thargoid hunter, there's even a Thargoid bobblehead which can be obtained (somewhat barbarically) by handing over ten meta-alloys and one Thargoid Heart!

How do the brave pilots of the galaxy actually choose to utilise these things, and why? We asked for your feedback, and your responses were numerous and entertaining. Some are simple, some are funny, some heartbreaking or romantic – but they are all individual and all reveal a little something about the commander who chose them.



I personally put my alphabet bobbleheads to spell out 'Tweet Tweet' because I always name my ships after different birds.

- Icarus Maru



I brought the planets of Sol with me on Distant Worlds 2, to remind me where I started and where I was supposed to end up again.

- PrimetimeCasual



“ All I usually have is a lone wireframe Coriolis to remind me where I came from.

- Eid LeWeise



“ Usually I use the Earth and the human bobblehead in the middle and I surround them with a whole Thargoid fleet.

- Maskime

“ I just tend to slam whatever seems fitting. Planets, beacons and such for exploration; ships or skulls for combat ships. I use them just to enhance the atmosphere. Sometimes I use only one or two, but most often the dashboard is flooded. Also add Christmas lights for extra cheesiness.

- Erno



As for this correspondent, I try to add something unique to the dashboard of every ship I own. While working for the Fuel Rats I typically had 'FUEL+', which is comms shorthand for "I have successfully delivered fuel". On my mining ships I have 'MINE' (well, it's certainly not yours) and on my trade ship I have the handy advice 'BUY-SEL+'.

It's as a member of the Buckyball Racing Club however where I really unleash the bobbleheads, coming up with something different for every race. For the comedy chase caper-themed Aquarian Job I reminded myself to 'FLOOR IT'; for The Last Gasp (a zero oxygen race) I had 'O2 CMDRS'; and for Galaxy's End (a pub crawl-themed event) I used 'DOWN IN1' and 'SWIFT1'. My race-tuned Imperial Courier reminds me that it's actually 'TOO FAST' while my Mamba expresses the sheer joy of flying with 'YEAH BABY'.

It's in my Python, however — the ship above all others that I choose to call home — where I think I've said it best. For the last five years, the words 'NOW WHAT' have expressed, not the boredom of running out of things to do, but quite the opposite: the mild but good-humoured irritation that comes from unexpected interruption and the promise of adventure where it was least expected.

We'll leave you with a final thought. If bobbleheads and other such frivolous cockpit adornments are not for you; if these silly trinkets fill you with nothing but annoyance, why not celebrate this fact and emblazon your dash with an all-time classic:

'REEEEEEEEEE'

“ Here are mine! Two pilots and a Braben bobblehead in white and gold! A wonderful reminder of many chats with many folks at various pilot expos — including helping with the Buckyball Races as spearheaded by Cmdr Turner.

- Jon



“ I don't spell anything out, most of them are just fun or whatever grabs my fancy. However... every one of my ships has a female commander bobblehead in it at the very least. That's my wife... I don't like being anywhere without her.

- One half of a well-known husband/wife galactic photography team who wishes to remain anonymous

Dashboard dictums

Text: Alec Turner

Images: Alec Turner, Byrnolf, Buur Pit, Ky Vatta, Millstonebarn, sulu, Fredonné

Design: Donald Duck

RARE COMMODITIES SPOTLIGHT



THE MASTER CHEFS



It is, perhaps, a sad commentary on contemporary affairs that human beings can fall into the category of 'commodity'. Willing or not, it is a fact that our fellow man falls often into the category of assets, to be accounted for and itemised like any other resource. Yet such categorisation is perceived as necessary and voluntary; employment is a matter of mutual agreement. Even slavery in the Imperial style is a self-chosen state, regulated and seen as an honorable path.

But what happens when one's profession, however skilled, isn't a choice?

Enter the Master Chefs. Raised from childhood in draconian conditions, Master Chefs are masters of cuisine, able to create one or a hundred meals with precision and finesse. Their exact training regime is a strict secret, but the results are undeniable. So too is the controversy that surrounds them.

Banned in Federal and Alliance space, Master Chefs have found a niche in Imperial circles. To employ one is seen as a status symbol, since to even procure them requires connections beyond the norm. It is perhaps no coincidence that Master Chefs originate from Viracocha – a system operated by the EG Union, independent but traditionally predisposed toward the Empire.

This is not to say that the use of Master Chefs is without controversy, even within Achenarian society. The distinctions between conventional slavery and the Imperial model, though spurious to critics, are of great importance to Imperial traditionalists. When asked for comment, a spokesperson from Aisling Duval's 'Stop Slavery Stupid' organisation told us:

"We see the use of Master Chefs as being no better than any other facet of slavery. They are essentially brainwashed prisoners, taken in childhood – more an automaton than a person. No gourmet meal is worth the cruelty behind its preparation!"

Your correspondent booked a transport to Viracocha itself, meeting a representative of the secretive organisation that recruits the children who become the next generation of Master Chefs. The man declined to share his name, speaking only on a condition of anonymity. He is dressed immaculately, as though a symbol of the precision for which the Chefs are known, his every syllable clipped and exact. A pronounced Slavic accent thickens his words.

"There are many who call us monsters for starting so young in the recruiting process," he begins. "Yet in truth only a tiny portion of those considered are even accepted into the program, and of them only a minority emerge from the years of training. Even those with the genetic cooking potential may lack the other... shall we say... ingredients needed to become a Master Chef."

He is clearly pleased at his clever turn of phrase. This correspondent presses him for details.

"The ideal candidate will be predisposed toward not only precision and rote task mastery, but will be unable to experience fatigue and 'burnout'. Their two-hundredth poached egg for the day must be as perfect as the first. Our clients demand no less, after all."

And just who are 'lucky' enough to be considered for induction into the Master Chef program?

"Our talent scouts search endlessly for children of the correct disposition. All too often these children are misunderstood savants, marginalised by their peers and misunderstood by the societies in which they languish. We offer them something better."

And as to the allegations of kidnapping? The man laughs, shaking his head.

“Propaganda, nothing more. The candidates are often in dire circumstances. Induction into the program lifts them from a life of exclusion and bereavement. To refuse to release one’s uniquely gifted child into our care is not only bad business but simply irresponsible. Suffice to say that we make it worth the parents’ while.”

Despite being pressed for such, the contact was unwilling to produce any parents or current inductees for this story. The training, he claimed, was far too rigorous to allow for something as intrusive as a stranger asking questions. Parents, he further claimed, are kept strictly anonymous.

It was the work of weeks to not only track down a bona fide Master Chef, but also one willing to speak. The woman who this correspondent eventually interviewed is more like a machine than a human being, her expression blank and her tone flat. She sits perfectly still, hands on her lap, features unremarkable and hair tied back in a precise bun. Her clothing is a stark white, snug-fitting and free of superfluous accessories, presumably to remove anything that could touch or snag an expertly-crafted dish.

“I answer to only one name,” she states. “And that is Master Chef. That is what my kitchen staff call me. That is what my employer calls me. Most importantly, that is what those who trained me in my craft finally called me after I passed the trials.”

This might be a tantalising glimpse into how exactly Master Chefs are trained. What, it is asked, takes place at these trials?

“Everything,” she states. “The student must prepare not merely a single dish, but an entire banquet. They must lead a staff of less-advanced students, preparing multi-course meals fit for presidents and emperors. They must walk the line between hands-on craftsmanship and hands-off leadership. More importantly, everything must be perfect. The ingredients, the prep work, the coordination,

the cooking, and the presentation.”

Exactly how perfect are we talking?

“Precision is instilled into the inductees at an early age. A cup of flour is measured with advanced instrumentation down to the number of grains, for example. The technique for inserting and removing a dish from an oven to ensure minimum temperature variation. Knowing how to predict exactly how a dish will smell, taste, and feel in one’s mouth, customised to the client’s specifications. Ensuring that a dish that takes an hour and thirty-one minutes to prepare is ready at the same time as one that takes ten. Even the passing of seconds can mar perfection, whether in the oven or waiting for a side dish. And believe me, the judges will know if those seconds have elapsed.”

The woman pauses. Intelligent eyes sharpen.

“Two banquets are prepared. One is by the resident Master Chef. The other, by the student. When their work is indistinguishable, the student becomes the newest Master.”

And then?

“And then the student leaves. And cooks. For whomever has purchased their contract.”

And what of the Master Chef’s own desires and ambitions? The woman blinks, her expression a muted frown.

“A utensil cannot perform a function other than its intended design. To think otherwise is foolish. I am a Master Chef.”

There is a final part to the fact-finding. The Master Chef has volunteered to cook a simple, time-honored meal for this correspondent. Her kitchen is massive, but she needs only a single burner. Lithe hands move with long-instilled precision. Eggs, cloned and identical, are broken into a self-heating pan in rapid fashion, their nearly-whole shells discarded without a glance. One hand whisks the yolks

The dish, as simple as it is, is precision, in the same way that a frameshift jump is precise, cold mathematics at work in an equally cold universe.

into a consistent slurry, the other controlling the exact temperature of the pan. Spices are added in precise measurements and distribution. Milk and cheese leaven the creation.

Before my eyes the slurry thickens into scrambled eggs, its texture perfect, no chunk seemingly larger or smaller than the others. A silver fork and silk napkin are set. The Master Chef waits.

This correspondent takes a bite.

The meal, a Federation staple, is perfect. Not only in the sense of flavour, texture, and temperature, but of start-to-finish consistency. There is no homemade randomness or improvisation, no folksy quality to make the meal unique. Each bite tastes exactly like the one before, as though the grains of spice themselves were placed in a precise, three-dimensional grid within the finished meal. The dish, as simple as it is, is precision, in the same way that a frameshift jump is precise, cold mathematics at work in an equally cold universe. Yet this is food, not interstellar travel. Words, though this correspondent’s craft, fail to describe the finished product. It must be experienced, not merely eaten.

Still, I prefer my mother’s scrambled eggs.



Rare commodities spotlight:
The Master Chefs

Text: M. Lehman

Images: Adobe Stock

Design: McNicholl

MISSION FARSIGHT

Mission Farsight has become a familiar name to many. For over three years, the crew of the *Hermes* have been exploring the Milky Way, guided by its captain, Commander Picard. In September last year they hit the remarkable milestone of 1,000 days spent in deep space — surely a record.

We caught up with Picard and his crew via telepresence.

**Space. The final frontier.
To explore strange new
worlds, to seek out new life
and new civilisations. To
boldly go where no one has
gone before.**

This is the (strangely familiar) expedition statement for Mission Farsight, whose captain your correspondent is here to meet.

The man standing at the front of the *Hermes* makes for a crisp, attentive, professional presence aboard the bridge of the Beluga-class starship; a presence only partly undermined by the happy-looking Australian Shepherd wagging his tail at his feet.

"My unofficial co-captain Drover," Picard says with a grin. "He oversees my cabin's security."

The pair are overlooking a star that has quite probably never been seen by human eyes before. But Picard invites me to follow him elsewhere, taking me on a brief tour of the ship. Finally we emerge into an arboretum, improbably full of trees, benches and small low-light lamps. Above us, a massive piece of glass covers the entire area — beyond which an unfamiliar firmament twinkles.

"The best view in the galaxy," Picard says, smiling. "I believe this area has kept all of us sane over the years. I figured we could continue our interview here."

At the time of writing, Mission Farsight has endured an incredible 1,198 days in interstellar space. During that time, the vessel *Hermes* and its crew have encountered incredible forms of stellar phenomenon, dealt with numerous maintenance problems, kept an incredibly detailed Captain's Log, and named many Earth-like worlds after various commanders following its exhaustive mission. The mission's public log has become something of a Pilots' Federation institution, with thousands of followers celebrating Picard's discoveries.

We sit down to talk.



Thank you for giving us your time, Commander.

Mission Farsight began as a one-year expedition; and yet here you are, considering embarking upon your fifth. What keeps you out here?

Many people across the galaxy have asked us the same thing. We [the crew of the Hermes] have always been motivated by the same drive: to get others to see the beauty of the galaxy. To inspire other explorers and commanders to jump into the black. To see the untold wonders of the universe. With a growing number of supporters telling us we've inspired them, we made the decision to continue on our journey for the same reason we started. To help inspire others.

Now, regarding the mission: we have actually changed the flight plan quite a bit with each extension. The first flight plan only had us circumnavigating the galaxy. So with each extension we take a long, hard look at the progress from the previous year, and decide if we want to continue on or if it's time to go home. So far each year the decision has been to extend.

Is inspiring others enough of a motivation to beat back the loneliness of the deep black?

Isn't everything in life simply about the journey and how you can inspire others to do just a little bit better? To be there in times of struggle to lift others up?

I will admit that I wanted to see the far edges of the galaxy. The universe is so massive, with over 400 billion systems that we know of in our galaxy alone! So many untold discoveries. We really don't know all she has to offer yet. But the driving force has been to share the journey of this expedition with others, especially once we gathered a following to our Captain's Log.



“ We do it because if it helps just one person feel better or make their day a little brighter than we have already accomplished our mission and will continue to do so.

How did you come up with the concept for Mission Farsight?

The Mission itself began to take shape around the end of 3301 and 3302. I had personally taken out two other ships — the Icarus, a Type-7, and the Kelvin, an Anaconda — on several month-long voyages to different deep space destinations. But nothing as vast as this sort of scale.

As I did a bit more research I saw that only a few commanders had ever even attempted a circumnavigation [of the galaxy], which honestly surprised me a little bit. We thought about taking an Anaconda at first but we wanted to do something [different] and provide a ship that was unique to the scope of the mission. The Beluga had recently been released, and I and the crew decided that was the ship to guide us into the starry night.

It seems unorthodox (even dangerous) for an exploration team to be broadcasting their location and mission information.

We have many that have followed our story for years, and several that come and resupply the Hermes on a regular basis. The two most prominent being Cmdr Unifex and Cmdr HighwayWarrior. During year one we met with the pair, and they have since kept up with us, supplying much-needed materials.

The Captain's Log seemed like the most logical way to share the far reaches of the galaxy with those back home. While we do maintain a 'Captain's Eyes Only' section of the log that is not available for public consumption, I would venture a guess and say nearly 95% of all our discoveries have been shared with the galactic community. The rest we plan to share with everyone upon our return.

An incredible amount of detail and care and attention has gone into these logs, and you've shared a tremendous number of pictures of planets and vistas with the folks back home. When it comes to the data collected about Earth-like worlds, is it your policy to immediately share

that location — even if it risks another pilot banking the discovery?

While our most pertinent location information is not shared on the public log for security reasons, we make a sole exception: Earth-like worlds. We have a tradition aboard the ship to name each Earth-like world after one of the followers of the Captain's Log, and we share the location with them. We take great effort to name them after followers or commanders at Pilots' Federation Headquarters.

By our estimation, when this is over we will have visited over 50,000 systems. Plenty of room in this galaxy to let a few commanders enjoy a destination to visit — their own Earth-like world.

We've also noticed it can really make a follower's day, as was the case with Commander Michael last year. He was quite a lad. After having the honour to speak with him before his passing, we had the pleasure to name one Earth-like world after him, and it really made him perk up. He was truly a remarkable kid.

What were the early goals of the mission, and how have they changed over time?

The goals of the mission were simple and have not changed since the beginning: to discover what is out in the galaxy. We had heard rumors of many things, and what better way to find out than to just head out?

Each extension has had its own motivations, but it has primarily been driven by the community of commanders who follow the log. When we set up the log in early 3303, it had gathered about forty-five followers by the time we actually left for Day 1 of Mission Farsight. At this time we have in excess of 2,300 followers.

To see messages like "You inspired me to get back into my ship and explore" truly touches us every time. Or, in the case of Cmdr Michael, to hear how much impact something like naming an Earth-like world after him made... It was truly touching and not something I will soon forget.

We do it because if it helps just one person feel better or make their day a little brighter then we have already accomplished our mission and will continue to do so.

Have you stopped at many deep-space stations during the years you've been out here?

Though we have not returned to the Bubble, we certainly became well-acquainted with it prior to our departure. Our last Bubble stop was Lefthoven Beacon, where we picked up the remainder of the crew on 1st January 3303. We have stopped at several deep space outposts after we completed our circumnavigation of the galaxy. I believe the closest station to the Bubble we have stopped at was Farsight Expedition Base, which is in the Heart Nebula.

Are the crew drawn from across all human societies? And, if so, are there ever tensions between them?

We do carry members from all three major factions, yes, but those selected were chosen because of their scientific minds, not their loyalties. Those aboard swore an oath to discovery and the betterment of all mankind. After a year or so most of the nonsense 'political' alignments fell away as the crew became a family.

Will you be visiting Colonia this year? It must have been strange to watch a whole new Bubble develop there since you've been out in the black.

Our current flight path has us going right by Colonia at the end of 3306. Depending on the mission status at the time, we may very well pay her a visit.

When we left, Colonia was in its infancy. Partial service to Jacques station had only been restored after it was lost for months, after its failed jump attempt to Beagle Point. It was only put back online in July 3302, and we departed on our expedition in January of 3303. Mission prep was underway at that time, but Jacques station was pretty much all that was out there. I don't even believe it was named Colonia at the time.

“ I guess you could say our ship is a bit of a time capsule.”

When you started the expedition, Felicity Farseer was developing rudimentary engineering modifications. Now, the galaxy is on the cusp of building a deep space network of Fleet Carriers. New ships, weapons, exploration tools, Guardian components... It must feel like quite a lot of change. Do you feel your vessel is becoming a time capsule?

What has not changed I think would almost be a better question.

This has become the crew's life. When we left, the following had not been invented yet: repair limpets, surface-scanning probes, the Camera Suite, neutron-boosted jumps, just to name a few. Humanity had not made contact with Thargoids when the ship departed. So much has changed in the Bubble, but we seem to be insulated from it. The change, while it does come from time to time to us out here, has not changed the mission. Maybe made exploration a bit easier, but yes... I guess you could say our ship is a bit of a time capsule.

In the beginning of our voyage repair limpets did not exist; and so, for our first two years, we dealt with a hull that had withered down to 80% integrity before we received proper repairs.

Are you never tempted to head back to civilisation to equip the *Hermes* with some of these new technologies?

The crew has never given the idea of improving our frame shift drive system with any modifications [much thought] — much less Guardian components — since we left inhabited space. Our current thirty-two light year range is plenty decent to get us through pretty sparse environments, and has proven successful in a complete circumnavigation as well as traveling in the sparse area between the galactic arms. There is also the matter that, with an increased jump range, we [would] visit fewer systems, which goes against our spirit. We are here to see as much as we can.

Are there others to whom Mission Farsight owes its success?



So much has changed in the Bubble, but we seem to be insulated from it.



I certainly would like to thank Commanders HighwayWarrior and Unifex for their continued trips out to the Hermes to make sure we have everything we need.

Special thanks must be given to the Fuel Rats, who came to the Hermes' aid in the early days of the mission, ensuring its continued presence out here in the black.

And, finally, the pilot community, without whom we would be nothing.

This community has been the backbone of Mission Farsight. It seems at least once a week that I get a positive comment or a message like "You inspire us to get back into the black". To know that we have inspired and helped lift up those people who have been so supportive in return...

Late last year I lost a dear friend. After some hesitation I posted about it on the Captain's Log and received an outpouring of messages, direct messages, and just well-wishes. It was very touching.

Another example of how absolutely amazing this community is: on day 1,000 of our mission we had followers fly thousands of light years to come and visit and enjoy the celebration. Even Commander David Braben himself sent us a congrats message. I believe SAGI did a segment as well!

All of these things show how powerful and supportive this community is, and I hope it will remain so far into the future.

Thank you for taking the time to meet us, Commander. Your contributions to the world of exploration are incredible, and your messages and ongoing Captain's Log certainly inspires pilots across the Pilots' Federation.

We truly appreciate all that Sagittarius Eye does for the galaxy! Please, we have a celebration feast [planned] in the 'Explorer's Last Front', our on-board social lounge. We hope you have an extra night on board!

Sadly your correspondent couldn't take Picard up on his offer, much though he wanted to.

As the *Hermes* ended its communication link, one couldn't help but feel reinvigorated; motivated to take another look at what this galaxy has to offer. Is now the time to head out ourselves?

Picard is an icon of exploration among explorers, and his love of exploration has come to embody Mission Farsight. But it's not his achievements that have humbled us today; it's his deep compassion for humanity and generosity of spirit.

To boldly go where no one has gone before...

Cmdr Picard wishes to thank the remarkable men and women of Pilots' Federation Support, to whom he credits no small part of the success of Mission Farsight.



Mission Farsight

Text: Alexander Sepulveda

Images: Picard, TwoSpoons77

Design: Donald Duck

Thanks to: Picard

DATA-DRIVEN COMBAT

HULL EMISSIVITY AND THE THARGOID WAR



Every commander knows that a cool-running ship is a stealthy ship, but just how close can you really get before you are noticed? Your correspondent flew to the headquarters of the Anti-Xeno Initiative (AXI) at Ceres Tarn in HR 1185, Pleiades Sector, to learn about their recent ground-breaking research in this field.

Ceres Tarn sits defiantly on a 4G world, bathed in an otherworldly purple light that throws its gritty industrial landscape into harsh contrast. Perhaps the planet was chosen to deter the faint-hearted from landing. Here a good chunk of the anti-xeno war machine is sourced, assembled, and maintained. Commanders Maligno and Mechan are very much at the heart of that effort, and were easily found supervising repairs on their respective ships *The Mangler*, a Krait Phantom, and *Xenokiller AX-001*, a Chieftain.



MECHAN



MALIGNO



TALEDEN

Coffee and whiteboards

We adjourned to their joint office within the AXI HQ complex, where they patched in Commander Taleden, developer of the ship design suite EDSY, via HoloVid.

Mechan explained that Taleden had been invaluable during the course of the project. "I had some questions about heat dissipation — he answered them magisterially." Maligno concurred: "When I did a deep dive into weapon damage splits last year, he was one of the few figures in the community that took my findings seriously." (SAGI #25, p58)

Taleden smiled. "Good times. Some of those engineers, you know, they're crazy savants. They twist and tinker and cross wire a module and it takes us months of field testing to even fully understand what they did to it."

We settled down over coffee to discuss the project in depth. Mechan explained that it originated as one of AXI's science projects, springing from a desire to refine the 'cold orbiting' technique used against Thargoid Interceptors. Maligno could no longer stay away from the whiteboard: "Knowing your ship's emission

characteristics allows you to know how closely you can approach without drawing direct fire or triggering special attacks. That allows you to dispatch the Interceptor quickly and with minimal hull damage."

Mechan sprang up. "So, being the engineer I am, I set out with the question: 'What is the exact formula for detection range?'"

It took Commander Mechan a couple of weeks to research the matter, via a painstaking technique of fine-tuning the target ship's heat output and having colleagues with defined sensor configurations move very slowly back and forth to determine the cut-off distance. Taleden's insights into heat generation and dissipation rates were crucial. Looking at a mass of plots, Mechan remembers thinking, "This looks quadratic somehow. But quadratic of *what?*"

It turns out that introducing a new hull characteristic, dubbed "Hull Emissivity (E_{hull})", resolved the issue neatly. "I still very much remember the look on Mechan's face when he had that 'Eureka!' moment," said Maligno.

Here comes the science part

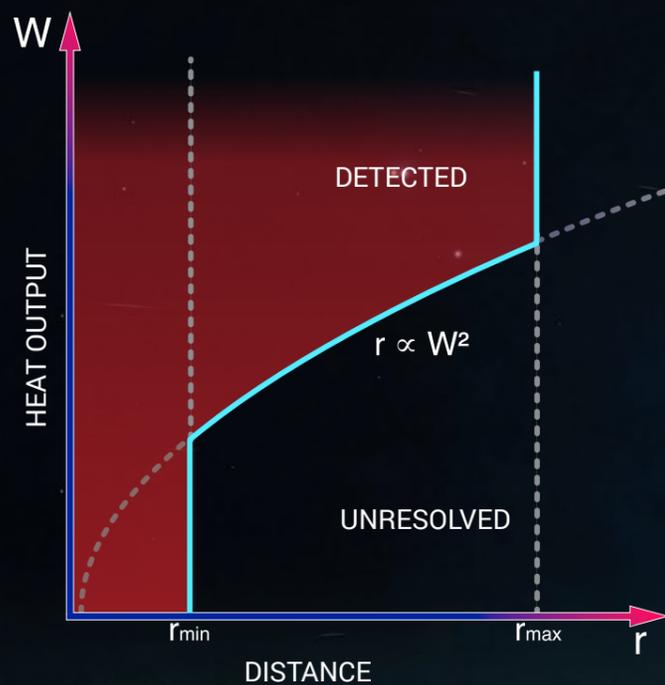


Figure 1

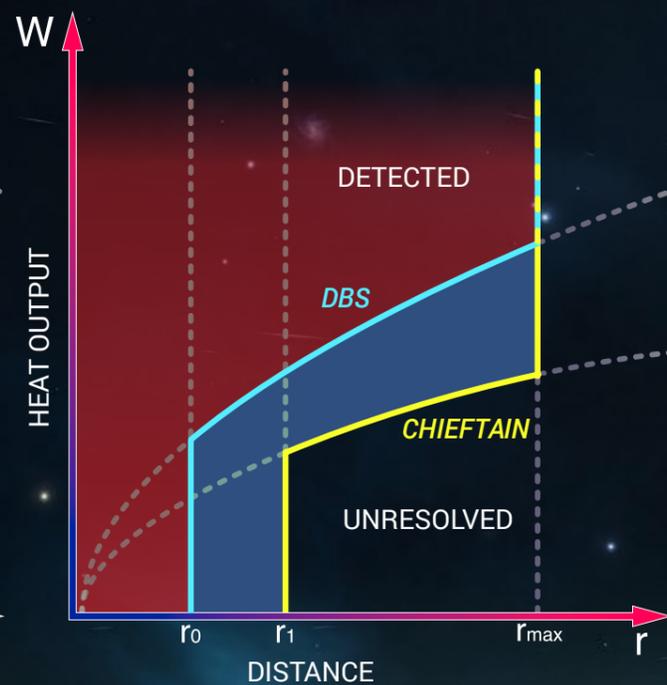


Figure 2

Think of figure 1 as a game board where 'left' is closer and 'up' is hotter. 'r' stands for the distance between target and observer and 'W' for the target's heat output (see the sidebar for more precise definitions). The blue zone describes how close you can get without being detected. In the red zone you are detected.

The chart falls into three sections:

- If you get closer than r_{min} you will always be detected.
- If you get beyond r_{max} you are never detected.
- In between, the detection range is proportional to the square of the target's heat output.

r_{max} depends only on the observer, being their scanner's maximum range. This has been known for some time.

AXI's key finding is that r_{min} is proportional to the target's hull emissivity ($r_{min} = TER \times E_{hull}$). This explains why ships with very low hull emissivity, such as the Diamondback Scout (DBS), can get much closer than other ships and remain undetected.

The boundary follows a quadratic law which turns out to be:

$$r = r_{min} \times W^2 = TER \times E_{hull} \times W^2$$

As we will see in the next chart, this makes hull emissivity doubly important.

In figure 2 we see how, compared to the DBS, the Chieftain's worse hull emissivity gives it both a worse r_{min} and a much worse heat response curve. Even a moderate heat output is enough to make the Chieftain detectable all the way out to maximum range.

The turquoise area shows where the DBS can dance whereas a Chieftain would be detected.

Known hull emissivities:

Ship model	Hull emissivity
Anaconda	12.1%
Chieftain	10.2%
Diamondback Scout	5.4%
Diamondback Explorer	5.7%
Hauler	7.3%

Scanner characteristics

Typical Emissions Range (TER): the key range metric for a scanner suite, shown in the outfitting screen.

Maximum Range (MER): the maximum range for a scanner suite. This starts at 8 km for all unengineered scanners. Engineering for long range increases both TER and MER by the same proportion.

Target characteristics

Fuel consumption (f): the ship's rate of fuel consumption, shown by the HUD in tonnes per hour.

Power Draw (PD): the total amount of power that all the ship's modules are drawing from the power plant. EDSY can provide a detailed report, and in normal space it can be calculated by $PD = f \times V_H$.

Power Plant Efficiency (PEff): the proportion of Power Draw that is expelled from the ship as heat (unlike the textbook definition of efficiency, lower is better here). This is shown in the outfitting screen and can be reduced by engineering for Low Emissions.

Thermal Load (TL): the power that is expelled from the ship as heat. $TL = PD \times PEff$

Hull Emissivity (E_{hull}): a dimensionless coefficient characteristic to each ship model's hull and radiator configuration. It relates the ship's thermal load to its detectable heat output and is the subject of much research.

Heat Dissipation (HD_{min} , HD_{max}): how fast the ship's radiators can dissipate heat (same units as power). This range is not shown in outfitting, but can be viewed in EDSY. Below around 15% heat, the ship radiates at HD_{min} . This increases up to HD_{max} at 66% heat. If thermal load exceeds HD_{max} then the ship's temperature will rise until something is done.

Thermal Load Factor (W): the ratio of the ship's thermal load to its minimum heat dissipation. $W = TL / HD_{min}$

Physical constants

Hydrogen Fusion Value (V_H): the amount of energy per unit mass released by fusing hydrogen into helium. Conventionally expressed in megawatt-hours per tonne ('MWh/t'). Equal to 12.5 MWh/t with current power plant technology.

Math quick reference

$$\begin{aligned} PD &= f \times V_H & r_{min} &= TER \times E_{hull} \\ TL &= PD \times PEff & r &= r_{min} \times W^2 \\ W &= TL / HD_{min} & r_{max} &= MER \end{aligned}$$

Conclusions and further research

So far you have run controlled experiments with human ships as the detector. Have you been able to make any correlations with Thargoid detection ranges?

Mechan: That is a very, very good question. My next initiative has been to reverse engineer the Thargoids' Typical Emission Range. We do know that their *maximum* range is 13.5 to 15 km — beyond that range they will lose target lock and wake out. Interestingly, that is roughly equivalent to human sensors after grade 5 long range engineering. My current hypothesis is that Thargoid sensors are equivalent to fully engineered 4A, 5A or 6A sensors. That would place their TER between 11.7 and 12.6 km, but we have yet to test this hypothesis.

Have your findings changed your Anti-Xeno tactics, and if so, how?

Maligno: The research results have helped me explore how close I can get to a Thargoid Interceptor without triggering special attacks, such as caustic missiles and the Shutdown Field. For instance, I now know that if I kill a Thargoid Heart I can linger as close as 560 meters from the Interceptor in silent running, which then allows me to take my time and position myself for the next phase of the fight. I suspect that under similar circumstances a Diamondback Scout could get as close as 450 meters.

Mechan: It has contributed to the increased popularity of the cold-running Krait Phantom build, of which Maligno is a fan, and which Arianonros Stormrage used to demonstrate the first ever 'perfect Hydra kill' (killing a Hydra without ever taking a hit: no damage taken whatsoever).

1. Know your minimum detection range. Assume the worst: presently a class 8A sensor suite with grade 5 long range engineering has a TER of 13,440m.
2. Look for ships with both a low hull emissivity and a high maximum heat capacity, for example the Diamondback Explorer and Scout.
3. Outfit the ship so as to be just below its minimum heat dissipation at operating level. Further reductions yield no benefits, not even when silent running. The easiest way to do this is to disable unnecessary modules when stealth is desired. EDSY is very useful here.

What do you reckon are the most important takeaway messages for non-combat commanders who don't want to be detected (smugglers, carriers of secretive passengers, etc)?

Maligno: If you want to smuggle a modest amount of cargo, or transport only a handful of passengers, then the Diamondback Scout is an excellent choice. I hope that as research progresses more people will come to appreciate the DBS as a great platform for tactical smuggling. In the regime of medium ships, the Krait Phantom equipped with a low emissions power plant is also a great choice.

What are your next objectives for this research?

Maligno: I feel that the research is still in its infancy and will be ongoing for months to come. We've only gathered data on a handful of ships, so we still need to do a comprehensive analysis that looks at all ships available for purchase. That is something that will take a great deal of time, effort, and coordination. And, as noted by Mechan, we will eventually expand the analysis to Thargoid Interceptors.

Our [initial research paper](#) is available on the Pilots' Federation forums.

We'd welcome any commanders wishing to help! Please join us in the #science-projects channel in [AXI's communications hub](#).

Thank you for your time!

Both commanders' data pads chime. It seems that their ship repairs are complete. Your correspondent heads back to his own ship and watches the two of them lift off for another round of combat. Ancient Earth mythology used to speak of a bygone age of warrior-philosophers. Perhaps the 34th century is the age of warrior-scientists.

“ Some of those engineers, you know, they're crazy savants. They twist and tinker and cross wire a module and it takes us months of field testing to even fully understand what they did to it. ”

*Data-driven combat:
hull emissivity and the Thargoid war*

Text: VerticalBlank

Images: OrangePheonix, TwoSpoons77, Mechan

Design: LexMoloch

Thanks to: Maligno, Mechan, Taleden

GOING ROGUE

IN SEARCH OF WANDERING WORLDS

It is thought that uncountable numbers of so-called 'extragalactic planets' might be out there in the cold nowhere between galaxies.

Planets. Every commander has seen them countless times during their career. Many have even discovered and left their tag on some. Most of them orbit stars — most, but not all.

In this article, we take a look at the so-called rogue planets. Lonely and cold, they drift through the void...

When travelling through space, commanders encounter planets all the time. They orbit stars — some closer, some farther away — and their temperatures vary as a result. And then there are those that are *freezingly* cold. Not because their star is too small or too far away, but because they don't orbit a star at all. These are called 'rogue planets'.

To define what a rogue planet is, we first need to define what a planet is. Astronomically speaking, a planet can be either a body orbiting a star or a stellar remnant. The primary criteria are (a) having enough mass for gravity to pull the body into a round object ('hydrostatic equilibrium'), and (b) not having enough mass to trigger thermonuclear fusion in the core. Candidates also have to clear their surroundings of planetesimals: small, solid objects that are believed to play a big role during planet formation.

This definition implies that the planet is the dominant gravitational object in its orbit around its parent star (so natural satellites like moons don't count, as they are under the direct gravitational influence of the planet). A planet's mass can reach from 0.06 Earth masses (such as Mercury) up to about thirteen times the mass of Jupiter. That is the critical mass for the thermonuclear fusion of deuterium to start, at which point the objects cease to be planets and become brown dwarfs, something between a dull star and a very large planet.

When a star forms out of giant clouds of molecular hydrogen there is usually some leftover material. This material takes the shape of a disc: the 'protoplanetary disc'. 'Proto' means 'before'; this disc comes before planets are formed. As this disc slowly cools, small dust grains form, made of rock and ice. These grains coalesce into kilometre-sized planetesimals, which collect mass ever more quickly as they grow larger. Collisions between these planetesimals may speed up this process until protoplanets — and later, real planets — are formed.

Rogue planets do not orbit a star. Instead, they orbit the centre of our galaxy directly; or even not at all. It is thought that uncountable numbers of so-called 'extragalactic planets' might be out there in the cold nowhere between galaxies, forever. Most planets are formed as part of a planetary system, as described above — so how does this happen?

Planetary systems often look quite orderly, from our point of view, billions of years after their formation. All planets neatly tucked into their orbits, many of which are almost circular. Things are not this quiet and ordered, however, during the early stages of a planetary system. Some think that Jupiter at one point came close to the orbit of Mars and twice passed through the area known today as the asteroid belt. During both of these transits it swallowed enough material to make the formation of a planet within that region impossible. The material left in that part of the Sol system amounts not even to the mass of Earth's moon.



Gas giants

Gas giants are formed in a similar way to planets, at least initially. Further out in a planetary system, where temperatures are much lower, they start forming from larger quantities of ice and rock. It is believed that five to ten Earth masses are needed for objects to begin collecting hydrogen and helium gas. While this is a slow process to begin with (taking millions of years), once the mass of the protoplanet reaches about 30 Earth masses the material accretes in a runaway manner – and massive planets like Jupiter and Saturn in the Sol system collect the bulk of their mass in only 10,000 years. This process only stops once there is no more gas in their orbit for them to collect.

Massive planets like Jupiter and Saturn in the Sol system collect the bulk of their mass in only 10,000 years.

These kinds of events may happen in many young star systems: planets changing orbits, temporarily or permanently. And when planets the size of Jupiter move within a star system, the gravitational forces within that system shift greatly as well. When one of these massive planets (and its gigantic gravitational field) comes close to another planet several things could happen – but one possibility is that the gravitational forces yank the smaller planet out of its former orbit and into a highly unstable one. The smaller planet could then be ejected from the star system completely, marking the beginning of a very long and lonely journey orbiting the centre of the galaxy.

Another possible cause of such a planetary ejection is the fly-by of another star or similarly massive object, such as a black hole. The gravitational forces these huge objects exert upon a star system are enormous, and very much able to pull several bodies out of a star's orbit.

The final way in which rogue planets might form are as so-called 'sub-brown dwarfs'. These are objects of planetary mass that form in a similar manner to stars: clouds of gas and other materials collapse, but the mass of the cloud is not enough to form an object capable of thermonuclear fusion. The resulting objects orbit the galaxy as cold and dark planets that never know the warmth of a sun.

How do we know these objects exist? They don't emit any kind of electromagnetic radiation, be it light or microwaves. They also don't have bright objects orbiting them, such as black holes. They do, however, have mass – and mass bends light. 'Gravitational lensing' occurs when massive objects bend space around them, and the path of light gets bent with it. Commanders can experience this phenomenon readily, by flying close to a black hole.

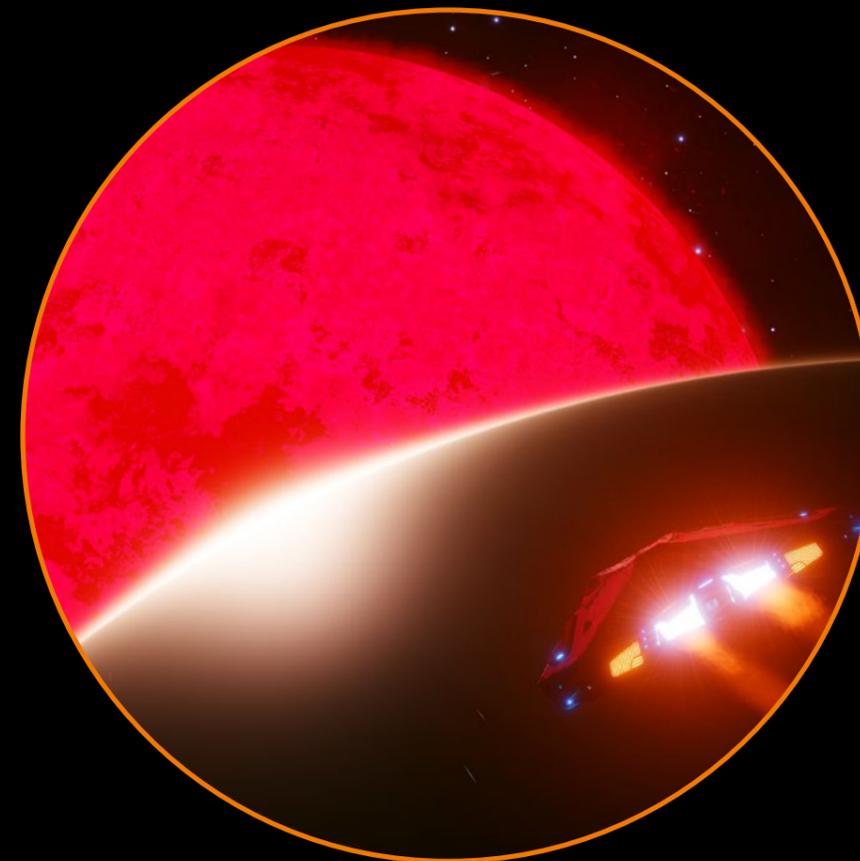
Gravitational microlensing is the phenomenon through which rogue planets may be discovered. Light

from objects far away is slightly bent when it hits our optical instruments. This normally happens when light travels past massive and bright objects like stars or galaxies; but there are occasionally recordings in which there is no visible object to bend the light, but the effect is too slight to be a black hole. These objects seem to be of similar size to large planets or the smallest stars – bingo, rogue planets.

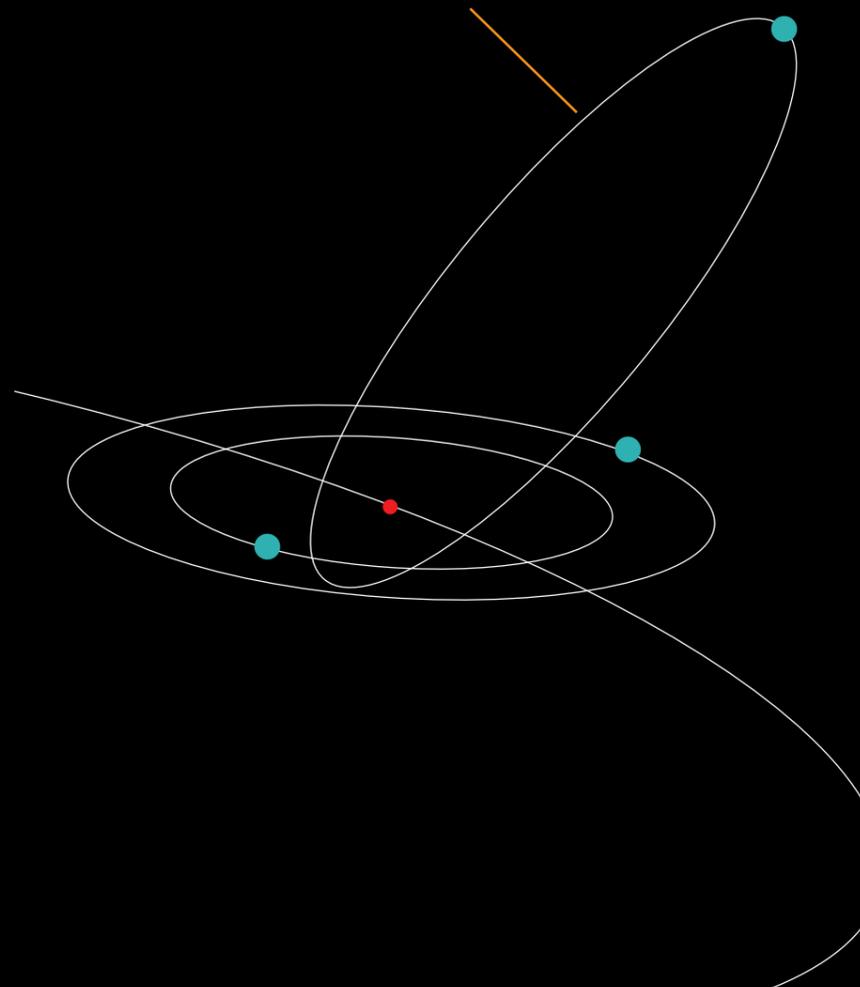
How do these planets look? They are certainly cold and dark places. Their surface temperature is very close to the temperature of empty space, which is very close to absolute zero. Depending on the way they form, there may be some leftover warmth within them where some kind of life may at some point may have developed, or might do so in the future. The sub-brown dwarf type would be comparable to a gas giant, while the rocky worlds ejected from their star system would likely be solid. Any kind of atmosphere would soon start to freeze after ejection, and fall towards the surface, where all liquid water that may have existed there would have long since frozen.

This would likely be the end for most rogue planets. However, it is conceivable that a rogue planet might be captured by a star and find a stable orbit around it. This could then thaw the planet up again to awaken it, even allowing the possibility of life forming on it. That would be a remarkable journey indeed.

How common are they? More common than you'd think. Some scientists think there might be more rogue planets in the Milky Way than there are stars. Other, more conservative, estimates put their number in the billions. However, they're hard to find. They don't appear on our galaxy map; the smallest objects catalogued there are brown dwarfs, which begin at thirteen Jupiter masses. All of the objects on the galaxy map are much easier to find than rogue planets, as they all emit some kind of radiation.



Possible rogue planet orbit



Some scientists think there might be more rogue planets in the Milky Way than there are stars.

And yet, we may still be able to visit them, in a way – when rogue planets are captured by a star and fall into a stable orbit, they become easier to find. If you take a look at the orrery map in a system, take note of the eccentricities of the planetary orbits. Captured rogue planets come from outside the system, and it takes them a very long time to settle into a stable and circular orbit. A highly eccentric (very elliptical) orbit, or an orbit angled against the ecliptic plane, can both hint that a planet's origin lies outside of its current star system. Such planets may even have a retrograde orbit (ie, they move in the opposite direction of all the other planets in the system). A good example for a captured moon is Triton, the innermost moon of Uranus in Sol, which is thought to be a captured Kuiper Belt object.

So, if you find a planet like this in a system, you might have discovered a former rogue planet, captured by that star's gravity. A planet that has travelled thousands of light years on its way to its new home.

Going rogue: in search of wandering worlds

Text: LordTyvin

Images: Zer0axis, Exorcist

Design: McNicholl

It's easy to think of the movement of galaxies as a serene, stately rotation. However, although the timescales involved are bafflingly large, the reality is that galaxies are turbulent, violent places, home to eddies and patches of turbulence, and frequently collide with their neighbours. The evidence of this can be seen all around us.

Another well-known moving group is the **Castor Moving Group**, containing Castor, Fomalhaut, Alderamin, Vega and Kappa Phoenicis among others. The group contains another 80-odd stars spread over a wider area. This is due to the fact that while travelling (and inevitably passing other stars and massive clouds of gas) these stars lose some of their momentum due to gravitational interaction with their surroundings. The result is called 'mass segregation' – when the cluster or group begins to disperse and aggregate into the galactic disc.

The rotation of our Milky Way is mostly driven by the massive tidal forces of Sagittarius A*, the supermassive black hole in its centre. However, not all stars share a uniform direction of movement. Many stars form inside the galaxy's spiral arms in their own highly dynamic environments, full of magnetic fields, local gravitational forces and turbulent, energetic interstellar gas clouds. In such 'lively' neighbourhoods groups of stars are almost always formed with their own movement and kinetic energies, which they inherit from their birthing gas clouds. These don't necessarily match the movement vector of the galactic plane.

This is how galactic stellar streams are born. These are massive groups of stars that, while orbiting the galactic centre along with the rest of the galaxy, also have their own vectors and velocities, making their trajectories distinctive and not always in line with their surroundings. These streams are also known as **Moving Groups**. For early astronomers, studying them was essential in order to understand the formation of star clusters in particular and the formation of galaxies in general.

Among those moving groups the **Ursa Major Moving Group** (also called Collinder 285) is perhaps the most prominent. Most stars of the Big Dipper asterism, including Alioth, Merak, Mizar and Alcor, are members of this group and form the core of today's Alliance of Independent Systems.

Two good examples of this phenomenon are the **Pleiades Group** and the **AB Doradus Group**. They don't share a close neighbourhood today, but that wasn't always the case: astronomers have traced both groups' trajectories and velocities back to a common region of space.

There are still about a dozen companion galaxies under 500,000 light years away, likely to be drawn in, given time.

The principles of cluster formation, group movement and mass segregation are deeply entwined. Most star clusters we know of today move with momentum they gained when 'ejected' from their birthing molecular cloud.

Even humanity's cradle, Sol, must have belonged to a moving cluster of stars in the distant past. To find out, a number of explorers set out towards **Messier 67** on the Distant Stars expedition in early 3303. M67, dubbed the 'Cancri Cluster', lies high above the galactic plane and – because of striking similarities in age, prevalent spectral types and stellar metallicity – was theorised to be the origin of the Sol system. The expedition was a one-way trip for all involved since at the time the final approach could only be made in a highly specialised ship and with a frame shift drive (FSD) boost from a neutron star.

Stellar streams

OF THE MILKY WAY

Another much closer example of a moving group is the **Hyades Stream**, a stream containing portions of the Hyades Cluster and its surroundings, implying that the moving group is bigger than the cluster itself. This stream is in the process of mass segregation due to the surrounding gravitational and magnetic forces. This fate eventually awaits all stellar streams within the galactic disc; over time they will lose their own momentum and vector and be subsumed into the more uniform orbit of the galactic centre.

The streams mentioned so far originate in our own Milky Way galaxy, and are testament to the very lively and dynamic environment in which stars and clusters evolve, giving them their own starting velocities before they are eventually conformed to our galaxy's gigantic tidal forces. But these forces do not end at the galaxy's edge — they reach into the far galactic halo.

Take the **Arcturus Stream**, for example, centred on Arcturus and containing roughly 50 nearby stars. The parts of Alison City and its more notorious counterpart Brennan Depot are familiar to many travellers, but few visitors to Arcturus know that they are docking in an extragalactic star system. Arcturus and the stars surrounding it are thought to have formed around seven billion years ago in what must have been an early dwarf companion galaxy. The group still moves at an astonishing 270,000 miles per hour (half the velocity of Sol), but it does so not along, but perpendicular to, the galactic plane, leading astronomers to conclude that they are a remnant of an earlier impact with another galaxy.

The environment of the galactic halo is as dynamic as that inside the Milky Way's disc, only on a much larger scale. It is clear today that a large part of our galaxy's formation is due to galactic collision. When galaxies collide, the ensuing tidal forces rip the local gas clouds apart and also capture stars in the process. Galaxies draw each other together, the smaller colliding with and passing

Its history with our galaxy is far from over, however, as it is bound to collide with it again and again.

through the larger, in ever-tighter orbits until they are absorbed. These collisions leave long tails of stars and dust in their wake. Sped up, the process looks violent, but it's hard to imagine the timescales over which these dances take place.

The Milky Way has collided with and partially absorbed many other smaller galaxies throughout its history, creating many stellar streams that orbit the galaxy in its halo. There are still about a dozen companion galaxies under 500,000 light years away, likely to be drawn in, given time — before the Milky Way itself collides with the far larger Andromeda galaxy in the distant future.

The most prominent stellar stream may be the **Magellanic Stream**. It's a stream of mostly hydrogen and loose groupings of stars that stretches over a distance of 180,000 light years and an angle of 180 degrees below the galactic plane. The stream is the result of multiple galactic interactions (not necessarily direct collisions) between the Magellanic Clouds and the Milky Way. The two clouds have so far been able to retain their own overall integrity and orbital movement vectors, despite shedding mass. The result is a gigantic 'bow' of interstellar material, stretching into the void.

The **Sagittarius Stream** belongs to the Sagittarius Dwarf Elliptical Galaxy (SDEG), a companion orbiting the Milky Way in a polar orbit. This dwarf galaxy has pierced the Milky Way's galactic plane several times and left an exceptionally large elliptical stream of gas and stars in its wake, forming a big polar loop around our galaxy. Some of the SDEG's stars are at least eight billion years old and have very low metallicity, making them among the oldest extragalactic stars in the

Milky Way's halo. The dwarf's core is around 70,000 light years away and numerous globular clusters, including the beautiful Messier 54, have been identified therein. Its history with our galaxy is far from over, however, as it is bound to collide with it again and again — until, one day, it is completely absorbed.

It's a promising area of further research. With private frame shift travel and ever-increasing jump ranges, it should be possible to trace the stream's length to the 70,000 light years-distant SDEG, if one were to identify areas of sufficient stellar density to mark the way. A project for a budding explorer, perhaps?

Going there to have a look doesn't always solve the mysteries, however. The dispute over the hypothesised **Monoceros Ring** continues to this day. The model revolves around a stream of stars of a theorised companion galaxy called the Canis Major Dwarf Galaxy (CMDG). The stream allegedly circles the Milky Way multiple times in a very tight orbit in the outer Monoceros and Canis Major constellations; so tightly, in fact, that it was postulated that a number of star clusters of unusual old age — thought to be the CMDG's core — should line the galactic rim, approximately in the Perseus Fade region between the Perseus and the Outer Arm. Critics quickly pointed out that the supposed stellar stream's tight orbit may also be the result of warps or ripples in the spiral arms and that in fact the stream was just an extension of the Milky Way itself. The Children of Raxxla's Monoceros Mission in June 3303 tried to gather sufficient data to prove either the one hypothesis or the other, but wasn't able to discover anything conclusive.

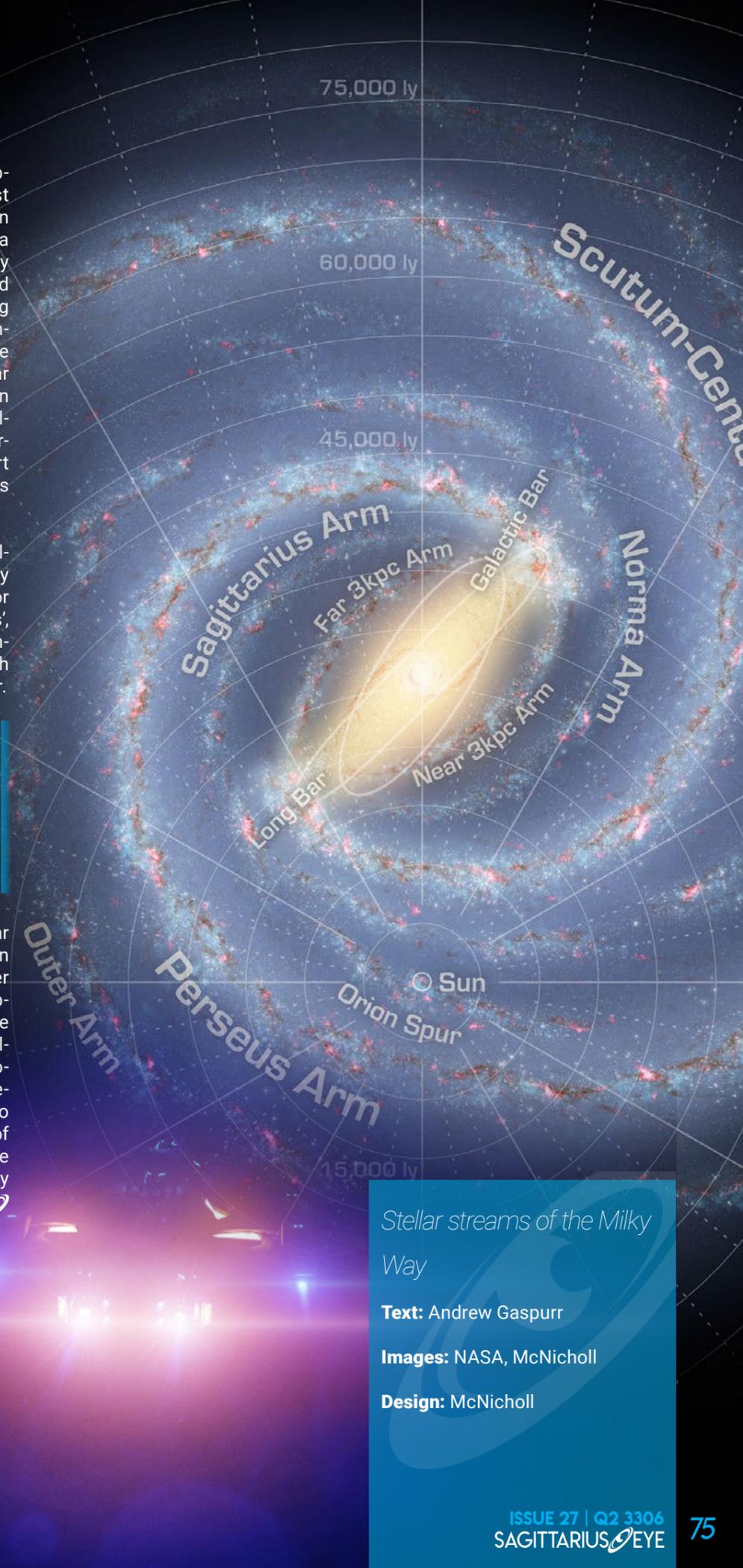
The **Virgo Stream** is an example of a galactic merger which isn't in doubt. The stream's original dwarf galaxy doesn't even have a name any more; it's referred to as the Virgo Radial Merger and it's assumed to have been almost entirely consumed by the Milky Way by now. It was only discovered after unexpected discrepan-

cies in stellar composition were observed during the creation of the first 3D models of the Milky Way back in the 21st century. Scrutiny of the area of space proved difficult, as it lay along the galactic plane, obscured by stars and dust. With increasing interest in that area, however, scientists were finally able to identify the merger and an accompanying stellar stream that's 30,000 light years in length but which has now been almost completely absorbed. The Virgo Stream is now well and truly part of the Milky Way, despite its stars forming elsewhere entirely.

These are just a few examples of stellar streams, in and around the Milky Way disc. Search your database for the 'Bootes' or 'Aquarius Streams', 'Lamost 1', 'Palomar 5' or even 'Fimbulthul', the stream associated with the Omega Centauri globular cluster.

The group still moves at an astonishing 270,000 miles per hour (half the velocity of Sol).

All stellar streams trace their peculiar origins back to interactions between galaxies, and nearly all trail a number of galactic core remnants and globular clusters. The examples above help illustrate that neither is our galaxy a static, uniform disc of monotonous movement, nor is the space beyond its disc empty and void. Its halo is filled with shreds and corpses of other, smaller galaxies that had the misfortune of colliding with a galaxy much larger than themselves.



Stellar streams of the Milky Way

Text: Andrew Gaspurr

Images: NASA, McNicholl

Design: McNicholl



Co-Pawlots



Commander name: Feiercrack
 Co-Pawlot name: **Nieve**

"My co-pawlot is Nieve, a fifteen year-young spacecow-boy. When we're on expeditions he always checks the best ways over the neutron highways, also the best starports with Ceti Rabbits, Witchhaul Kobe Beef, and Fujin Tea for his Hutton Mug!

"Last week he had to go to the doctors. He's got a heart disease (left heart valve insufficiency). He will likely die soon, if we do not find any Guardian or Thargoid Heart Implants. But for the last fifteen years he has always been my loyal companion.

"Just after I got divorced, this little boy found me in the mountainous region around Lake Garda in Italy, on Earth. He was only seven months young, and came to me two days before my birthday. We were at an open-air party in a mountain village. Suddenly he appears and jumps on me. Later, he vanished. I went back to my VW bus, opened the rear door, and suddenly he jumps out from behind a bush, directly onto the mattress inside the van! So I decided to take him home, back to Germany.

"I would be very proud to see him in SAGI. Cheers and o7 from the Germany sector!"

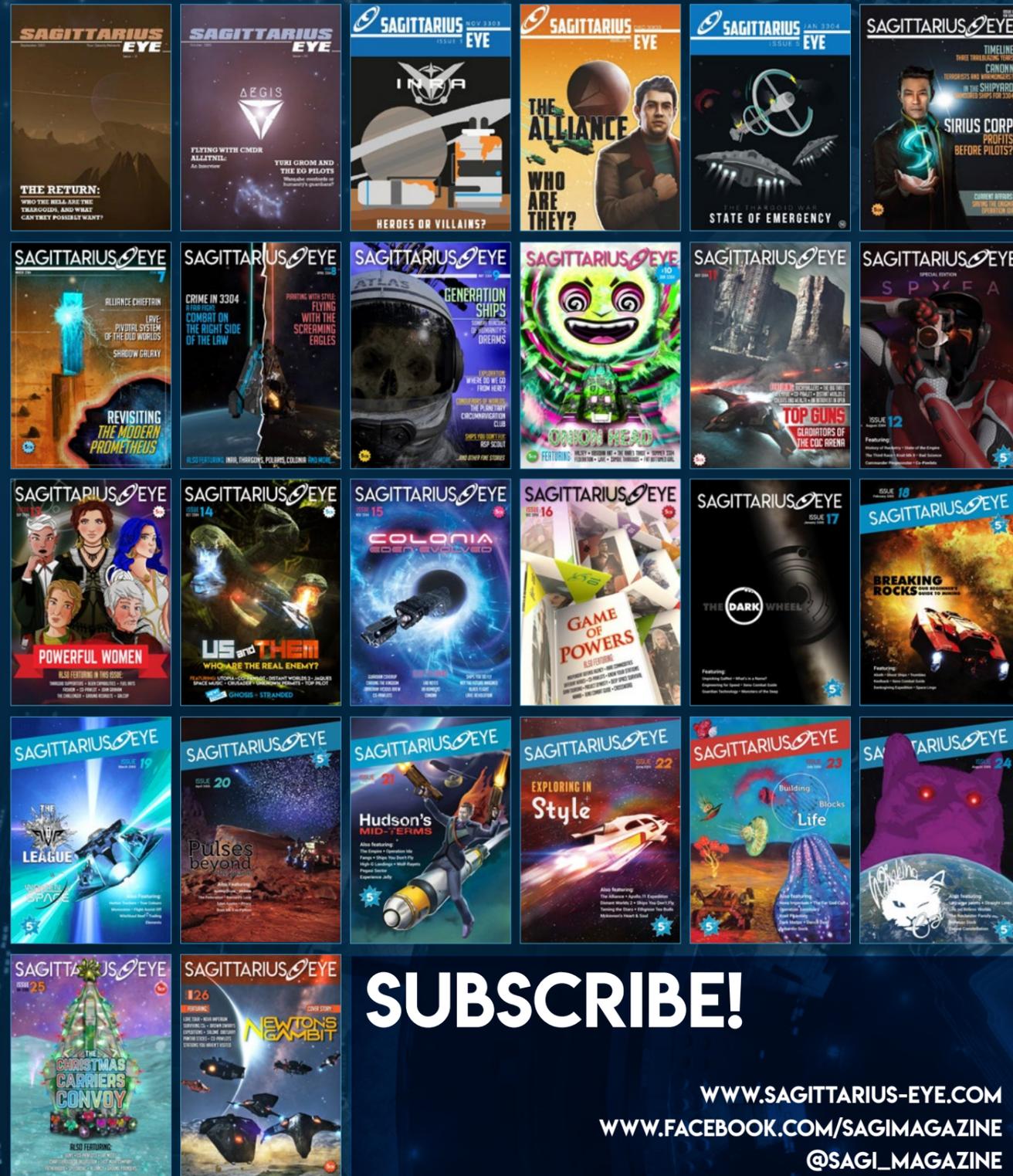
Co-Pawlots: Nieve

Design: LexMoloch

Thanks to: Feiercrack

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