

## Grand Galactic Actuary

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Euclid Jefferson, recently retired actuary, stepped off the MoonX tourist shuttle and into a dull gray meteor crater. He found unfamiliar the combined experiences of low gravity and his cumbersome spacesuit. Although he could leap ahead and quickly jump out of the crater, he found it challenging even to raise his arms. After a few minutes of tentative jump-walking, he slowly turned to observe the shuttle's pilot make a hasty takeoff. He wondered why he had been the only passenger on this particular flight. In the year 2036, such sparsely booked flights were not unheard of, but already quite uncommon. The weather at the spaceport had not been inclement, and the Archimedes Research Base usually attracted a steady flow of journalists, academics, and curiosity seekers. Why was today different?

The domes of the research base were lit only dimly, and the moonscape was strangely empty as he approached. There was no welcoming party – just a lone figure at the base entrance, clad in the field uniform of a lunar geologist, but without the tools. As Euclid approached, he discerned the face of his wife Hypatia. He had not seen her for a year; on Earth, he had received a series of experimental rejuvenation treatments that took approximately twenty years off of his biological age. She, having been moon-bound in the meantime, still had the appearance of a woman in her early fifties. Over her spacesuit, she still wore the necklace Euclid had given her before their wedding. They had planned to return to Earth together, where she would recover from the muscle and bone atrophy caused by prolonged low-gravity exposure, and then planned to receive the rejuvenation treatments herself. For now, though, she looked weary and showed relief, but no joy, at his arrival. Her expression predominantly showed deep alarm.

“Euclid – no time for greetings. The base has been evacuated. All world governments are on standby to see how this situation is resolved. You were able to come because only you were cleared to come. Your pre-scheduled trip to the base was the fastest opportunity for getting an actuary here. You – only you – are needed.”

“What?” Euclid was incredulous.

“We have made first contact with an alien life form. It *only* wants to speak to an actuary. It refuses to move until it has done so.”

Hypatia pressed a key on her remote control, and the door into the base's main dome slid away, admitting them inside. The research equipment had been cleared out, and no other human being was in sight. A few small utility bots scurried around the edges, performing routine essential maintenance, but the center of the dome's vast floor was occupied only by a massive, indistinct contraption, semi-shrouded in shadow. It seemed to be a makeshift structure – one supported by hundreds of thick, cylindrical, mechanical legs on top of which sat ten-meter-high black panels, arranged in a dodecagon, the center of which emitted a faint glow. Narrow cracks between the panels betrayed hints of slow, deliberative motion.

As the doors slid shut behind them, Euclid and Hypatia removed their helmets. “I am Euclid Jefferson!” Euclid shouted at the black structure. His voice echoed throughout the dome. “I am an actuary!”

The mechanical legs lifted briskly off the ground, floated in mid-air for a full second, then descended upon the floor with a resounding stomp.

“Well, here we finally are,” boomed a slow, bass voice *in perfect English*. It was a self-assured voice, almost at the edge of Euclid’s auditory comfort, but he did not perceive it as malevolent or threatening. The room brightened suddenly as half of the structure’s panels slid away, leaving six standalone, massive computer screens. Thousands of three-dimensional spreadsheets, hundreds of thousands of lines of code appeared before Euclid in characters that were themselves three-dimensional, each comprised of intertwined geometric shapes more intricate than anything he had ever seen. Altogether they created a sea of ever-shifting, ever-evolving alien text. It seemed to him that calculations were ensuing in mid-air, but what was being calculated and why remained a mystery. At each of the six screens sat ... *an upright tortoise? Two meters tall? Deep blue in everything – skin, shell, eyes? In a thick black overcoat with a cutout for the shell? Typing?* Was the low gravity getting to Euclid’s head?

“My loyal associates,” the voice resounded again. “I hired them as hatchlings. They reason well, but still need a few centuries to learn.”

Euclid remained perplexed. “Who are you? How can you speak English?”

The sea of letters receded, and out of the center of the structure emerged the largest tortoise Euclid had ever seen – also completely blue – also in a black overcoat, except with ornate ruffles around the neck, limbs, and shell. He sat on a colossal, four-meter-tall throne, wrought from millions of tiny fibers that nonetheless buoyed his massive frame. A comparatively small table floated in front of him, filled with several dishes of giant leaves folded into elaborate designs. The alien’s eyes regarded Euclid with a superior but also inexhaustibly patient gaze.

“You stand before Turtor the Old, Grand Galactic Actuary, Ratemaker of the Milky Way. For my analytical and data-gathering capabilities, renowned throughout the civilized universe, the absorption of your primitive Earth languages is but a moment’s afterthought – and I have long observed your species and its myriad perplexing exemplars.”

“Grand Galactic... Actuary?”

Euclid paused to think. It occurred to him that Turtor and his associates must be products of convergent evolution – unrelated to the tortoises of Earth but simply similar in their biological structures. They must have emerged on another world where slow, herbivorous, non-senescent terrestrial reptiles became the dominant life forms instead of primates. Euclid wondered what sort of world it must have been. A perpetually warm one, with plenty of plants? No predators? Ample space and time to deliberate?

“You humans have finally sent one who is worthy to speak to me. All I was offered before were some meaningless dignitaries: General, President, some Secretary of some strange organization pretending to represent ally our little tribes, your ‘nations’! Do you humans have no recognition that insurance rules the cosmos?”

“We had no idea that there was any sentient life apart from Earth!”

“This is no excuse,” boomed Turtor. “I have watched your world for centuries. You stumbled in the dark, speculating, but now you have emerged from your species’ infancy and can no longer evade the truth. You must now pay.”

“Pay for what?”

“Cosmic general liability insurance, of course.”

Euclid’s eyes widened. “What is this insurance you speak of?”

“Think back a few decades, in your world. When a teenager drove one of your primitive manual automobiles, he was required to purchase liability insurance. Even your primitive laws recognized the potential damage that an inexperienced young driver could inflict on others, so they required all drivers to provide financially for that eventuality. Now it is your species’ turn.”

“But what is the parallel here?” Euclid still did not understand.

Turtor let out a prolonged sigh. “I have all the time in the universe to explain, I suppose. Your species is no longer a child species. You have established a settlement on another world. Children who cannot drive do not need insurance. A child species that cannot colonize space does not need insurance to protect others from its depredations. But once you are out settling on other worlds, you can do great damage – just like a teenager driving one of your old Earth vehicles for the first time!”

“But respectfully, the Moon is a barren rock!” Euclid objected. “No other life exists here. We are only beginning to establish ourselves and master even this environment. We were not even aware of life forms on other worlds until you arrived!”

“We know your species sufficiently well to highly doubt that you will stop with the Moon,” Turtor replied. “There is a good reason why you were ignorant of the existence of other sapient species. As part of the Universal Insurance Mandate, those lacking required cosmic general liability insurance are shielded from any visual, auditory, or kinesthetic stimuli emanating from the rest of the galaxy’s inhabitants. Your species’ primitive efforts to search for extraterrestrial intelligence have yielded no signs to date precisely because of this. We have developed the ultimate risk-management strategy: avoidance of all contact with those who might do us harm and refuse to pay for the risk.”

“So we cannot contact other species unless we have cosmic general liability insurance – and who will sell us cosmic general liability insurance?” Euclid inquired.

“The Galactic Insurance Consortium – developed and operated by the most renowned actuaries of the Milky Way – exists for the sole purpose of maintaining, pricing, reserving, and selling insurance that accompanies all transactions of civilized beings. Whatever can be done, we provide the insurance policy that precisely covers all of the risks involved.”

Now Euclid was beyond intrigued. “A policy precisely tailored to each risk? How is this possible?”

“It is good that I am not in a hurry. You humans hurry too much, by the way – often pointlessly.” It was true that Turtor was taking his time to explain. “My species – whose name would be far too intricate to pronounce in your language but is translated literally as ‘Blueshellians’ – are the most skilled students of risk this universe has produced. Our ancestors took their time, wandering through our world’s lush meadows, eating leaves, and, most importantly, *pondering*. For all the time you humans devoted to slaughtering one another, we spent orders of magnitude more time thoroughly cataloguing and comprehending all the risks on our home-world and devising ways to mitigate them. You fragile humans can senesce and die... we only grow larger and stronger with age. Only accidents and infectious disease can destroy us – so the foremost focus of our work has been on preventing accidents and diseases and finding ways to quickly pay for repairing the unpreventable damage. By the time we were ready to venture out into space, we could anticipate every major contingency and threat. Any more warlike species had no means of defeating us, since our predictive models foresaw their strategies and devised the perfect defenses. Eventually they all realized that their best interest was to adopt the Universal Insurance Mandate and retain us to manage their risks. The system we have built undergirds the galactic order. Through insurance of everyone against every conceivable fortuitous peril, we give everyone a stake in peace and good behavior – and the primitive way of law enforcement through force has been made entirely obsolete. We actuaries have rendered obsolete the rulers and political systems of primitive species. You humans are actually fortunate to have evolved as late as you did; you would not have wished your first contact to have been with any of the conqueror species whom we supplanted.”

“But how can you possibly comprehensively anticipate all major risks?” Euclid pressed.

“You might call this ‘big data’ – except far vaster than your human minds or even supercomputers can encompass. I travel the stars in search of species that may soon enter the spacefaring era and seek to observe them over the course of at least a few centuries before they establish their first settlement outside their home planet,” Turtor explained. “My tour takes me to your region of the galaxy once every two of your decades, and this is my twenty-fifth visit. If I combine what I have learned of your species, those in similar stages of technological development, and those far more advanced, I can formulate reliable exa-variate predictive models of the risks facing humankind.”

“Are you claiming to be able to predict the future? Can you anticipate what I will do next?” Euclid was incredulous.

“You will continue to stand here, questioning me. But no, my models will not exactly foretell the future. They will, however, lay out the paths along which the future is likely to unfold, with reasonable accuracy as to the probability of each path.”

“So what are the major risks that your insurance policy would cover for humans?”

“Cosmic general liability insurance will compensate for the unintentional damage your species might inflict upon others. Your species has a propensity toward violence driven by tribalism and ideology. Not even my insurance can cover intentional malfeasance; for that, we would simply block you in perpetuity. However, as a result of human belligerence, you also still have eighty-year-old arsenals of nuclear missiles with astonishingly poor oversight. Our policy will cover the damage you humans might inflict on other species as a result of accidental nuclear launches. Your species also practices poor overall hygiene and may inadvertently transmit your Earth diseases to other worlds. Humans, furthermore, have a tendency to unthinkingly alter the climates in which they reside. If you introduce climate changes that are harmful to another sapient species, we have geoengineering controls in place to repair the damage, but the insurance policy will pay the cost of such repairs. And of course, there are miscellaneous coverages if any of you humans should unintentionally injure another sapient being or cause damage to its residence or spacecraft.”

Euclid was puzzled. “I can see how these risks would eventually exist after contact with other life forms, but what is the rationale for requiring the *entire species* to purchase the policy? Individuals, after all, are responsible for inflicting particular instances of damage. Not all people will even be capable of harming other species at any given time!” Then a thought occurred to Euclid as to how this mandate might be escaped. “Are you not introducing cross-subsidization if you require everyone to pay for the losses that only a few are responsible for causing?”

“No more than one of your human group or blanket insurance policies or social insurance systems would produce cross-subsidization today,” Turtor replied confidently. “As with those policies, it is simply far more convenient to encompass all potential sources of risk within the same policy – and that way the premium gets spread across a larger population with less burden on each individual.”

“So what is the premium in any event? You require us to purchase coverage for risks that we have long considered uninsurable and enormous in the potential severity of losses. How much money are you planning to charge us?” Euclid realized that it would be best to obtain all relevant details before devising a response.

“Money? Your governments’ fanciful pieces of paper, or your primitive electronic credit system? No,” Turtor replied. “We have advanced far beyond your economic structures and their cumbersome media of exchange. The payment we seek is something... more tangible. And you are correct; the risks are enormous. Indeed, it is a wonder that your species has succeeded in surviving to this stage of development. My model from nineteen years ago gave this outcome only a 45-percent probability. That was quite a dangerous time period you just overcame. Even your own scientists said then that you were... two and a half of your minutes from doomsday?”

“So if not money, what are you seeking? Resources?”

“In a manner of speaking. Unless your species changes its ways, the premium that would suffice to cover your first twenty-year policy term will be... hmmm... can those calculations be correct?” He gestured to one of his Blueshellian associates, who nodded in affirmation. “They must be: Two Earths.”

“Two Earths!”

“Yes, everything tangible on your planet, except for life forms, twice over. It would actually come out to 2.08616 Earths precisely – but, given the divisibility issues involved, I will give you a discretionary schedule-rating discount equal to the fractional Earth.”

“But this is impossible – even if we wanted to pay!” Euclid objected.

“Hence our dilemma,” Turtor noted matter-of-factly.

“Surely there must be other discounts, loss-prevention measures we can take to reduce the premium!” Euclid expressed a faint hope.

“This is why I needed to speak to an actuary. Yes, we have approximately 1.5 trillion discount possibilities built into the rating plan. The indicated premium for your policy adjusts in real time based on the known behaviors of individual humans as well as decisions large institutions within your societies. Ah – it looks like there is another civil war breaking out in your Sudan just now; you really need to stop having those! Were it not for my discretionary discount, your species’ premium would have risen by another 0.04 Earths as a result.”

“So what can we do? Nuclear disarmament?”

“That would save you 0.5 Earths. Not having the ability to destroy all sapient life forms from a centralized location is a good start.”

“That still leaves an impossibly high premium!”

“To solve the problem of infectious disease, you need to deploy nanobots that will detect and destroy harmful pathogens. We happen to offer them as a benefit to policyholders. As a bonus, they will also repair aging-related damage to your organisms far more seamlessly than your crude rejuvenation therapies. You might potentially live indefinitely like we do.”

“I would gladly take them if I could!” Euclid replied. Was there an opportunity to be had from all this?

“Very well, assuming they are deployed with haste, this results in a savings of another 0.8 Earths.”

“But now we at a premium of 0.7 Earths,” noted Euclid. “How could we possibly pay that?”

“Your planet has oceans covering approximately 70 percent of its landmass. You will cede the oceans to the Galactic Insurance Consortium,” Turtor responded. “It will not be obtrusive. Your ships will maintain right of way, but we will build monitoring platforms and maintain suitable habitats for all aquatic species. All oceanic resource extraction will now be performed by us; we can do it much more elegantly than you, with no long-term damage to any species’ population. We will trade with you for any resources you continue to extract from land. As part of our risk-management program, we will also maintain a permanent contingent of peacemakers who will live on the ocean platforms, observe your geopolitical dynamics, and interpose defensive shields around any humans who are about to be menaced by war or violent crime. If this results in a steady increase of peace and stability of your societies, you may, over time, become eligible for a conflict-free discount.”

It did not take Euclid long to decide. “An end to war and disease? Solutions to our environmental problems? In exchange for your oversight? This is a reasonable offer indeed! But what am I to do? I am but one traveler, one retired actuary! What authority do I have to make such a deal for all humankind?”

Hypatia tapped him on the shoulder. “You do not know?” She whispered to him. “All the governments of Earth and their intelligence agencies are tapped into this discussion. They have been listening all along! You were brought here as a last-ditch attempt to negotiate...”

“... And we can even hear your whispers!” another voice, harsher than Turtor’s reverberated throughout the room. “Mr. Jefferson, this is Director Mal Powers of the United States National Security Agency. We thank you for your efforts to communicate with the alien entity and discover its demands. Our diplomats have been in ongoing international deliberations regarding this proposal.”

“I recommend approval. This could be just what humankind needs to escape its age-old miseries and join the advanced species of the galaxy!” Euclid exclaimed.

“Yet there are those among the nations of the world who espouse a different outlook,” Director Powers replied. “The alien entity, they contend, is a threat to human civilization, our distinctive culture and way of life. There are many who say we cannot abide this alien influence transforming our economy, taking our jobs in fishing, oil rigging, medicine, and arms manufacturing! And if we allow these Blueshellians to settle on our planet, how soon before they have a demographic advantage over us? So there is now a vote at the United Nations.”

“A vote on the proposal? But what is the alternative? The status quo?” Euclid inquired with confusion.

“Remember, we still have nuclear missiles on high alert. Instead of dismantling them, which could render us vulnerable to a stealth invasion by the aliens, we could launch them preemptively at this base and solve the situation in this way!” Euclid was horrified. Powers had sounded almost *gleeful* at the prospect.

“Are you seriously considering this?!” Euclid was furious. “The destruction of the most sophisticated life form we have yet encountered? Because of xenophobia and protectionism?!”

“Mr. Jefferson, we thank you for your service, however unintended, but these policy decisions are simply beyond your realm of expertise. You are an actuary, and you have proved invaluable in negotiating with this... galactic tortoise actuary – but we will *remind* you to leave the important decisions to those true policymakers who have global security interests in mind!” That did not sound like a mere reminder.

“If you would, Director Powers, at least let us know how the United Nations vote is proceeding?” Hypatia attempted another approach.

“Well, apart from Canada and the Scandinavian countries, whose delegates voted in favor of this insurance scheme, your recommendation does not have much support, it seems. The United States is probably going to abstain; I would have recommended opposition – but it was determined that this would appear too inhumane for some constituencies. Still, I think the outcome is a foregone conclusion, as there are plenty of nuclear powers willing to launch...”

“WHAT YOU FORGET,” Turtor’s voice boomed suddenly, “IS THAT ACTUARIES RULE THIS GALAXY!” Turtor’s platform shot up in a furious ascent, then landed thunderously upon the floor. The screens of Turtor’s associates swiveled around so that Euclid and Hypatia had a full view of what they displayed.

Missiles in silos throughout the world, bearing American, Russian, Chinese, British, French, Iranian markings... were all crumbling! The screens flashed again. Rows of tanks and military aircraft were shown literally coming apart at the seams. Within moments, they were mere piles of scrap metal. The next series of screens showed what looked to be state-of-the-art cyber-command centers. Euclid spotted a scowling, incredulous man in uniform who must have been Director Mal Powers. All of his computers were melting before his eyes. His analysts, too, sat, speechless. The last set of images was from within the United Nations Building. The delegates of all the nations of Earth were shown with mouths agape at a gigantic projection of Turtor, seated on his throne, proclaiming, “YOU SHALL HAVE PEACE!”

Then the screens fell dark, and Turtor calmed. “They shall have peace, but not access to other civilized life forms – not yet. Your species’ morality and restraint have yet to catch up to your technological advancement. Explore the barren segments of the universe for now, if you wish, but you will not have access to anything truly remarkable. Perhaps in a century or two, we might reconsider.”

“But individual humans do not all share the same hostile inclinations! These proponents of reflexive violence do not represent me!” Euclid protested.

“Nor me!” Hypatia exclaimed.

“Hmmm...” Turtor pondered for a moment. “I suppose I can make an underwriting exception, since we did have a productive conversation. I can price a cosmic general liability policy for a



family of two. Associates, input the risk characteristics, please. Interesting... the underwriting system has accepted you.”

“But what will be our premiums?”

“This, I think, will suffice for the first policy term.” Turtor pointed to Hypatia’s necklace. “It has no real use-value in our economy – but our species also has retained a penchant for collecting shiny objects.”

Euclid turned to Hypatia. “This is a difficult choice... we can do it if you are certain.”

“Oh, it’s only a necklace!” she exclaimed. “The universe for a bauble? We accept!”