SUNSTORM

A TIME ODYSSEY: 2

ARTHUR C. CLARKE
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BALLANTINE BOOKS

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Part 1

A BALEFUL SUN

1: Return

Bisesa Dutt gasped, and staggered.

She was standing. She didn't know where she was.

Music was playing.

She stared at a wall, which showed the magnified image of an impossibly beautiful young ma crooning into an old-fashioned microphone. Impossible, yes; he was a synth-star, a distillation of th inchoate longings of subteen girls. "My God, he looks like Alexander the Great."

Bisesa could barely take her eyes off the wall's moving colors, its brightness. She had forgotte how drab and dun-colored Mir had been. But then, Mir had been another world altogether.

Aristotle said, "Good morning, Bisesa. This is your regular alarm call. Breakfast is waitin downstairs. The news headlines today are—"

"Shut up." Her voice was a dusty desert croak.

"Of course." The synthetic boy sang on softly.

She glanced around. This was her bedroom, in her London apartment. It seemed small, cluttere
The bed was big, soft, not slept in.

She walked to the window. Her military-issue boots were heavy on the carpet and left footprints
crimson dust. The sky was gray, on the cusp of sunrise, and the skyline of London was emerging fro
the flatness of silhouette.

"Aristotle."

"Bisesa?"

"What's the date?"

"Tuesday."

"The *date*."

"Ah. The ninth of June, 2037."

"I should be in Afghanistan."

Aristotle coughed. "I've grown used to your sudden changes of plans, Bisesa. I remember once—"

"Mum?"

The voice was small, sleepy. Bisesa turned.

Myra was barefoot, her tummy stuck out, fist rubbing at one eye, hair tousled, a barely awake eigh
year-old. She was wearing her favorite pajamas, the ones across which cartoon characters gambole
even though they were now about two sizes too small for her. "You didn't say you were comin
home."

Something broke inside Bisesa. She reached out. "Oh, Myra—"

Her daughter recoiled. "You *smell* funny."

Shocked, Bisesa glanced down at herself. In her jumpsuit, scuffed and torn and coated with swea
soaked sand, she was as out of place in this twenty-first-century London flat as if she had bee
wearing a spacesuit.

She forced a smile. "I guess I need a shower. Then we'll have breakfast, and I'll tell you all about
. . ."

The light changed, subtly. She turned to the window.

There was an Eye over the city, a silver sphere, floating like a barrage balloon. She couldn't te
how far away it was, or how big. But she knew it was an instrument of the Firstborn, who ha
transported her to Mir, another world, and brought her home.

And over the rooftops of London, a baleful sun was rising.

2: The Peak of Eternal Light

Mikhail Martynov had devoted his life to the study of Earth's star. And from the first moment he sa
the sun, at the beginning of that fateful day, he knew, deep in his bones, that something was wrong.

"Good morning, Mikhail. The time on the Moon is two o'clock in the morning. Good mornin
Mikhail. The time is two o'clock and fifteen seconds. Good morning . . ."

"Thank you, Thales." But he was already up and moving. As always he had woken to within
minute of his personal schedule, without need of Thales's softly spoken electronic wake-up call,
schedule he kept independently of the Houston time to which the rest of the Moon was enslaved.

Mikhail was a man of routine. And he would begin the day, as he began every day of his lon
solitary watches in this Space Weather Service Station, with a walk into the sunlight.

He took a quick breakfast of fruit concentrate and water. He always drank the water pure, nev
polluted with coffee granules or tea leaves, for it was water from the Moon, the result of billions
years of slow cometary accretion and now mined and processed for his benefit by million-doll
robots; he believed it deserved to be savored.

He clambered briskly into his EVA suit. Comfortable and easy to use, the suit was the result of si
decades' development from the clumsy armor worn by the *Apollo* astronauts. And it was smart, to
some said so smart it could go out Moonwalking by itself.

But smart suit or not, Mikhail worked cautiously through a series of manual checks of the suit
vital systems. He lived alone here at the Moon's South Pole, save for the electronic omnipresence
Thales, and everybody knew that low gravity made you dumb—the "space stupids," they called
Mikhail was well aware of the importance of concentrating on the chores necessary to keep himse
alive.

Still, it was only minutes before he was locked tight into the warm enclosure of the suit. Throug the slight distortion of his wedge-shaped visor he peered out at his small living quarters. He was man equipped for interplanetary space, standing incongruously in a clutter of laundry and unwashe dishes.

Then, with a grace born of long practice, he pushed his way out through the airlock, and then th small dustlock beyond, and emerged onto the surface of the Moon.

Standing on the slope of a crater rim mountain, Mikhail was in shadow broken only by spar artificial lighting. Above him stars crowded a silent sky. When he looked up—he had to lean back i his stiff suit—he could make out dazzling splashes of light high on the crater wall, places the lo polar sunlight could reach. Solar-cell arrays and an antenna farm had been placed up there in the ligh as well as the sun sensors that were the Station's main purpose.

This Space Weather Service Station, dug into the wall of a crater called Shackleton, was one of th Moon's smaller habitats, just a few inflatable domes linked by low tunnels and heaped over by a lay of charcoal-gray Moon dust.

Unprepossessing the hab itself may have been, but it was situated in one of the Moon's mo remarkable locations. Unlike the Earth, the Moon's axis has no significant tilt; there are no lun seasons. And at the Moon's South Pole the sun never rises high in the sky. There the shadows ar always long—and, in some places, permanent. Thus the pool of darkness in which Mikhail stood ha been unbroken for billions of years, save by humans.

Mikhail looked down the slope, beyond the low bulges of the Station domes. On Shackleton's flo floodlights revealed a complex tangle of quarries and lumbering machines. Down there robots toil over the real treasure of this place: water.

When the *Apollo* astronauts had brought home their first dusty Moon rocks, the geologists had bee dumbfounded that the samples contained not a trace of water, not even bound chemically into th mineral structures. It took some decades to unravel the truth. The Moon was no sister world of Ear but a daughter, created in the early days of the solar system when a collision with another infant wor had smashed apart a proto-Earth. The debris that had eventually coalesced into the Moon had bee superheated until it glowed blue-white, in the process driving off every trace of water. Later, come had splashed on the Moon's surface. Out of the billions of tonnes of water delivered by these less impacts, most had been lost immediately. But a trace, just a trace, had found its way to th permanently shadowed floors of the polar craters, a gift of water to the Moon as if in recompense f the circumstances of its birth.

By Earth's standards the Moon's water was little enough—not much more than a respectably size lake—but for human colonists it was a treasure beyond price, literally worth far more than its weig in gold. It was invaluable for the scientists too, as it bore a record of eons of cometary formation, an offered indirect clues to the formation of Earth's oceans, which had also been bequeathed by cometa impacts.

Mikhail's interest in this place was not lunar ice, however, but solar fire.

He turned away from the shadows and began to toil up the steepening slope of the rim mounta toward the light. The path was just a trail, beaten flat by human footprints. It was marked b streetlights, as everybody called them, small globe lamps hung from poles, so he could see what h was doing.

The slope was steep, each step an effort even in the Moon's gentle one-sixth gravity. His su helped, with a subtle hum from exoskeletal servos and a high-pitched whir of the fans and pumps th labored to keep his faceplate clear of condensed sweat. He was soon breathing hard, and his muscl ached pleasantly: this walk was his daily constitutional.

At last he reached the summit of the mountain and emerged into flat sunlight. A small collection o robot sensors huddled here, peering with unending electronic patience at the sun. But the light was to brilliant for Mikhail's eyes, and his visor quickly opaqued.

The view around him was still more dramatic, and complex. He was standing on the rim Shackleton, itself a comparatively minor crater, but here at its western rim Shackleton intersected th circles of two other craters. The landscape was jumbled on a superhuman scale: even the craters' fa rims were hidden by the Moon's horizon. But with long practice Mikhail had trained himself to mak out the chains of mountains, slowly curving, that marked the perimeters of these overlapping scar And all this was thrown into stark relief by the low light of the sun as it rolled endlessly around th horizon, the long shadows it cast turning like clock hands.

The South Pole, shaped when the Moon was young by an immense impact that had bequeathed it th deepest crater in all the solar system, was the most contorted landscape on the Moon. A greate contrast to the flat basalt plain of Tranquillity where Armstrong and Aldrin had first landed, far to th north close to the Moon's equator, would be hard to imagine.

And this peak was a special place. Even here among the mountains of the Pole, most places kne some night, as the passing shadows of one crater wall or another blocked out the light. But the peak o which Mikhail stood was different. Geological chance had left it steeper and a little taller than i cousins to either side, and so no shadow ever reached its summit. While the Station, only footste away, was in perpetual darkness, this place was in permanent sunlight; it was the Peak of Etern Light. There was nowhere like this on tipped-over Earth, and only a handful of locations like it on th Moon.

There was no morning here, no true night; it was no wonder that Mikhail's personal clock drifte away from the consensus of the rest of the Moon's inhabitants. But it was a strange, still landscap that he had grown to love. And there was no better place in the Earth–Moon system to study the su which never set from this airless sky.

But today, as he stood here, something troubled him.

Of course he was alone; it was inconceivable that anybody could sneak up on the Station without hundred automatic systems alerting him. The silent sentinels of the solar monitors showed no signs disturbance or change, either—not that a cursory eyeball inspection of their casings, wrapped in thic meteorite shielding and Kevlar, would have told him anything. So what was troubling him? Th stillness of the Moon was an uncomfortable place to be having such feelings, and Mikhail shivere despite the comfortable warmth of his suit.

Then he understood. “Thales. Show me the sun.”

Closing his eyes, he lifted his face toward the glare.

When he opened his eyes Mikhail inspected a strange sun.

The center of his faceplate had blocked much of the light of the main disk. But he could make o the sun’s atmosphere, the corona, a diffuse glow spreading over many times the sun’s diameter. Th corona had a smooth texture that always reminded him of mother-of-pearl. But he knew that th smoothness masked an electromagnetic violence that dwarfed any human technology—indeed, violence that was a principal cause of the damaging space weather he had devoted his own life monitoring.

At the center of the corona he made out the disk of the sun itself, reduced by the visor’s filters to sullen, coal-like glow. He called for magnification and could make out a speckling that might b granules, the huge convection cells that tiled the sun’s surface. And just visible near the very center o the disk, he made out a darker patch—obviously not a granule, but much more extensive.

“An active region,” he murmured.

“And a big one,” Thales replied.

“I don’t have my log to hand . . . Am I looking at 12687?” For decades humans had been numberin the active regions they observed on the sun, the sources of flares and other irritations.

“No,” Thales said smoothly. “Active Region 12687 is subsiding, and is a little farther west.”

“Then what—”

“This region has no number. It is too new.”

Mikhail whistled. Active regions usually took days to develop. By studying the resonances of th sun, immense slow sound waves that passed through its structure, you could usually spot maj regions on the far side, even before the star’s stately rotation brought them into view. But this beast, seemed, was different.

“The sun is restless today,” Mikhail murmured.

“Mikhail, your tone of voice is unusual. Did you suspect the active region was there before yo
asked for the display?”

Mikhail had spent a lot of time alone with Thales, and he thought nothing of this show of curiosit
“One gets an instinct for these things.”

“The human sensorium remains a mystery, doesn’t it, Mikhail?”

“Yes, it does.”

Out of the corner of his eye Mikhail spotted movement. He turned away from the sun. When h
faceplate cleared he made out a light, crawling toward him through the lunar shadows. It was a sig
almost as unusual, for Mikhail, as the face of the troubled sun.

“It seems I have a visitor. Thales, you’d better make sure we have enough hot water for th
shower.” He began to pick his way back down the trail, taking care to plan every step in advanc
despite his mounting excitement. “This looks like it’s going to be quite a day,” he said.

3: Royal Society

Siobhan McGorran sat alone in a deep armchair. She had her personal softscreen unrolled on her lap,
cup of rather bitter coffee on the occasional table at her side, and her phone clamped to her ear. Sh
was rehearsing the lecture she was to give to an audience of her most distinguished peers in less tha
half an hour.

She read aloud, “ ‘2037 promises to be the most significant year for cosmology since 2003, whe
the basic components of the universe—the proportions of baryonic matter, dark matter, and dar
energy—were first correctly determined. I was eleven years old in 2003, and I remember how excite
I was when the results from the Wilkinson Microwave Anisotropy Probe came in. I suppose I wasn’t
very cool teenager! But to me, MAP was a robot Columbus. That intrepid cosmology probe was se
off in the hope of finding a dark-matter China, but en route it stumbled over a dark-energy Americ
And just as Columbus’s discoveries fixed the geography of Earth forever in human minds, so w
learned the geography of the universe in 2003. Now, in 2037, thanks to the results we anticipate fro
the latest Quintessence Anisotropy Probe, we—’ ”

The room lights blinked, making her stumble in her reading.

She heard her mother tut. “And so on and so forth,” Maria said, her soft Irish lilt exaggerated by th phone’s tiny speaker. “In time, after a lot of technical guff about this old spaceship nobod remembers, I suppose you’ll grope your way back to the point.”

Siobhan suppressed a sigh. “Mother, I’m the Astronomer Royal, and this is the Royal Society. I’m making the keynote speech! ‘Technical guff’ is expected.”

“And you never were very good at analogies, dear.”

“You could be a *bit* supportive.” She sipped her coffee, taking care not to spill a drop on her be suit. “I mean, look where your little girl is today.” She flicked on her phone’s vision options so h mother could see.

These were the City of London Rooms in the Royal Society’s offices in Carlton Terrace. She wa immersed in rich antiquity, with chandeliers overhead and a marble fireplace at her side.

“What a lovely room,” Maria murmured. “You know, we have a lot to thank the Victorians for.”

“The Royal Society is a lot older than the Victorians—”

“There are no chandeliers *here*, I can tell you,” Maria said. “Nothing but smelly old people, myse included.”

“That’s demographics for you.”

Maria was in Guy’s Hospital, close to London Bridge, only a few hundred meters from Carlto Terrace. She was waiting for an appointment concerning her skin cancers. For people who had grow old under a porous sky it was a common complaint, and Maria was having to queue.

Siobhan heard raised voices in the background. “Is there a problem?”

“A ruckus at the drinks machine,” Maria said. “Somebody’s credit-chip implant has been rejecte People are a bit excitable generally. It’s a funny sort of day, isn’t it? Something to do with the od sky, maybe.”

Siobhan glanced around. “It’s not much calmer here.” As the start of the conference ha approached, she had been grateful to be left alone with her coffee and a chance to run through h notes, even if she had felt duty-bound to call her mother at Guy’s. But now everybody seemed to b crowding at the window, peering out at the odd sky. It was an amusing sight, she supposed, a clutch o internationally renowned scientists jostling like little kids trying to glimpse a pop star. But what we they looking at?

“Mother—what ‘odd sky’?”

Maria replied caustically, “Maybe you should go take a look yourself. You are the Astronome

Royal, and—" The phone connection fizzed and cut out.

Siobhan was briefly baffled; that *never* happened. "Aristotle, redial, please."

"Yes, Siobhan."

Her mother's voice returned after a couple of seconds. "Hello? . . ."

"I'm here," Siobhan said. "Mother, professional astronomers don't do much stargazing nowadays Especially not a cosmologist like Siobhan, whose concern was with the universe on the vastest scal of space and time, not the handful of dull objects that could be seen with the naked eye.

"But even you must have noticed the aurora this morning."

Of course she had. In midsummer Siobhan always rose about six, to get in her daily quota jogging around Hyde Park before the heat of the day became unbearable. This morning, even thoug the sun had long been above the horizon, she had seen that subtle wash of crimson and green in th northern sky—clearly three-dimensional, bright curtains and streamers of it, an immense structure magnetism and plasma towering above the Earth.

Maria said, "An aurora is something to do with the sun, isn't it?"

"Yes. Flares, the solar wind." To her shame, Siobhan found she wasn't even sure if the sun was nea the maximum of its cycle right now. Some Astronomer Royal she was proving to be.

Anyhow, though the aurora was undeniably a spectacular sight, and it was very unusual to be s bright as far south as London, Siobhan knew it was nothing but a second-order effect of the interactio of solar plasma with the Earth's magnetic field, and therefore not particularly interesting. She ha continued her jogging, not at all motivated to join the rows of slack-jawed dog walkers staring at th sky. And she certainly wasn't sorry she missed the brief panic as people had assailed the emergenc services with pointless calls, imagining London was on fire.

Everybody was still at the window. It *was* all a bit strange, she conceded.

She set aside her coffee and, phone in hand, walked up to the window. She couldn't see much past th shoulders of jostling cosmologists: a glimpse of green from the park, a washed-out blue sky. Th window was sealed shut to allow the air-conditioning to work, but she thought she could hear a lot traffic noise: the blaring of horns, sirens.

Toby Pitt spotted her at the back of the pack. A big, affable bear of a man with a strangulated Hom Counties accent, Toby worked for the Royal Society; he was the manager of the conference toda "Siobhan! I won't make jokes about the Astronomer Royal being the last to show any interest in th sky."

She showed him her phone. “No need. My mother’s already been there.”

“It’s quite a view, though. Come and see.” He extended his massive arm around her shoulders an with a skillful combination of physical presence and smiling tact, managed to shepherd her throug the crowd to the window.

The City of London Rooms had a fine view of the Mall, and of St. James’ Park beyond. The grass the park glowed lurid green, no longer a native specimen but a tough, thick-leaved drought-resista breed imported from southern Texas, and the relentless sprinklers sent sprays of water shimmerin into the air.

But the traffic in the Mall was jammed. The smart cars had calmly packed themselves up in a optimal queuing pattern, but their frustrated drivers were pounding at their horns, and heat haze ro in a shimmer in the humid air. Looking up the road Siobhan saw that the traffic control lights and lan guides were blinking, apparently at random: no wonder the traffic was snarled.

She looked up. The sun, riding high, flooded the cloudless air with light. Even so, when she shielde her eyes she could still make out a tracery of auroral bands in the sky. She became aware of a nois beyond the blare of the traffic in the Mall, a softer din, muffled by the thick sealed window. It was growl of frustrated driving that seemed to be rising from across the city. This snarl-up wasn’t loca then.

For the first time that day she felt a flicker of unease. She thought of her daughter, Perdita, college today. Perdita, twenty years old, was a sensible young adult. But still . . .

There was a new silence, a shift in the light. People stirred, perturbed. Glancing over her should Siobhan saw that the room lights had failed. That subtle change in the ambient noise must mean th air-conditioning had packed up, too.

Toby Pitt spoke quickly into a phone. Then he held up his hands and announced, “Nothing to worr about, ladies and gentlemen. It isn’t just us; the whole of this part of London seems to be sufferin something of a brownout. But we have a backup generator that should be coming online soon.” H winked at Siobhan and said softly, “If we can persuade the ratty old thing to start up in the first place But he raised his phone to his ear again, and concern creased his face.

In the heat of the June day, thirty-plus degrees Celsius, the room was already warming up, an Siobhan’s trouser suit was starting to feel heavy and uncomfortable.

From beyond the window there was a crumpling noise, a series of pops, like small fireworks, and din of wailing car alarms. The cosmologists gasped, a collective impulse. Siobhan pushed forward see.

That queue of traffic on the Mall was just as stationary as before. But the cars had lurched forwar each smashing into the one in front like a gruesome Newton’s cradle. People were getting out of the vehicles; some of them looked hurt. Suddenly the jam had turned from an orderly inconvenience into minor disaster of crumpled metal, leaking lubricants, and scattered injuries. There was no sign police or ambulances.

Siobhan was baffled. She had literally never seen anything like it. All cars nowadays we individually smart. They took data and instructions from traffic control systems and navigation satellites, and were able to avoid cars, pedestrians, and other obstacles in their immedia surroundings. Crashes were virtually unheard of, and traffic deaths had dwindled to a minimum. B the scene below was reminiscent of the motorway pileups that had still blighted Britain during h childhood in the 1990s. Was it possible that *all* the cars' electronic guidance systems had failed once?

Light flared, dazzling her. She flinched, raising her hand. When she could see again, she made out pall of black smoke, rising from somewhere to the south of the river, its origin lost in murky smo Then a shock wave reached the Society building. The tough old structure shuddered, and the windo creaked. She heard a more remote tinkle of glass, the blaring of alarms, and screams.

It had been an explosion, a big one. The cosmologists murmured, grave and apprehensive.

Toby Pitt touched her shoulder. His face had lost all its humor now. "Siobhan. We've had a ca from the Mayor's office. They're asking for you."

"Me? . . ." She glanced around, feeling lost. She had no idea what was happening. "The conferen —"

"I think everybody will accept a postponement, in the circumstances."

"How can I get there? If that mess outside is typical—"

He shook his head. "We can videoconference from here. Follow me."

As she followed his broad-shouldered form out of the City Rooms, she raised her own phon "Mother?"

"You're still there? All I heard was chattering."

"That's cosmologists for you. I'm fine, Mother. And you—"

"So am I. That bang was nowhere near me."

"Good," Siobhan said fervently.

"I phoned Perdita. The line was bad, but she's all right. They're keeping them at college until thing settle down."

Siobhan felt huge, unreasonable relief. "Thank you."

Maria said, "The doctors are running everywhere. Their pagers seem to be on the blink. You'd thin casualties would be coming in but I've seen nobody yet . . . Do you think it was terrorists?"

"I don't know." Toby Pitt had reached the door and was beckoning her. "I'll try to keep th

connection open." She hurried from the room.

4: Visitor

The rover reached the Station long before Mikhail had clambered his way back down the trail. Th visitor waited at the hab entrance with an impatience the surface suit couldn't disguise.

Mikhail thought he recognized the figure just by his stance. Though its population was scattere around its globe, on the human scale the Moon was a very small town, where everybody kne everybody else.

Thales confirmed it in a whisper. "That is Doctor Eugene Mangles, the notorious neutrino hunte How exciting."

That cursed computer-brain is teasing me, Mikhail thought irritably; Thales knows my feelings to well. But it was true that his heart beat a little faster with anticipation.

Encased in their suits, Mikhail and Eugene faced each other awkwardly. Eugene's face, a sculptu of planed shadows, was barely visible through his visor. He looked very young, Mikhail though Despite his senior position Eugene was just twenty-six—a maverick boy genius.

For a moment Mikhail was stuck for something to say. "I'm sorry," he said. "I don't get too man visitors out here."

Eugene's social skills seemed even more underdeveloped. "Have you seen it yet?"

Mikhail knew what he meant. "The sun?"

"The active region."

Of course this boy had come here for the sun. Why else visit a solar weather station? Certainly n for the crusty, early-middle-aged astrophysicist who tended it. And yet Mikhail felt a foolish, qui unreasonable pang of disappointment. He tried to sound welcoming. "But don't you work wi neutrinos? I thought your area of study was the core of the sun, not its atmosphere."

"Long story." Eugene glared at him. "This is important. More important than you know, yet. predicted it."

“What?”

“The active region.”

“From your studies of the core? I don’t understand.”

“Of course you don’t,” Eugene said, apparently careless of any offense he might cause. “I logge my predictions with Thales and Aristotle, date-stamped to prove it. I’ve come here to confirm th data. It’s come to pass, just as I said it would.”

Mikhail forced a smile. “We’ll talk it over. Come inside. You can see as much data as you want. D you like coffee?”

“They have to listen,” said Eugene.

They? . . . “About what?”

“The end of the world,” Eugene said. “Possibly.” He led the way into the dustlock, leaving Mikha standing openmouthed.

They didn’t talk as they worked their way through dustlock and airlock into the hab. Every human c the Moon was still a pioneer, and if you were smart, no matter what was on your mind, as you move from one safe environment to another through seals and locks and interfaces and in and out of EV suits, you concentrated on nothing but the life-preserving procedures you were going through. If yo *weren’t* smart, of course, you would be lucky if you were forcibly shipped out before you kill yourself, or others.

Mikhail, slick with daily practice, was first out of his EVA suit. As the suit slithered to its cleanin station—somewhat grotesquely, its servos dragging it across the floor like an animated flayed skin- Mikhail, in his underwear, went to a sink where he scrubbed his hands in a slow trickle of water. Th gray-black dust he had picked up handling the suit, grimy despite the dustlock’s best efforts, ha rubbed into his pores and under his nails, and was burning slowly with his skin’s natural oils, givin off a smell like gunpowder. The Moon’s dust had been a problem since the first footsteps taken her very fine, getting everywhere, and oxidizing enthusiastically whenever it got the chance, the du corroded everything from mechanical bearings to human mucous membranes.

Of course it wasn’t the engineering problems of Moon dust that were on Mikhail’s mind right nov He risked a look around. Eugene had taken off boots and gloves, and he lifted his helmet awa shaking his beautiful head to free up thick hair. That was the face Mikhail remembered, the face h had first glimpsed at some meaningless social function in Clavius or Armstrong—a face fresh hardened into manhood, but with the symmetry and delicacy of boyhood, even if the eyes were a litt wild—the face that had drawn him as helplessly as a moth to a candle.

As Eugene stripped off his spacesuit Mikhail couldn't help dwelling on an old memory. "Eugen have you ever heard of *Barbarella*?"

Eugene frowned. "Is she at Clavius?"

"No, no. I mean an old space movie. I'm something of a buff of pre-spaceflight cinema. A your actress called Jane Fonda . . ." Eugene clearly had no idea what he was talking about. "Never mind."

Mikhail made his way to the dome's small shower cubicle, stripped off the last of his clothing, ar stood under a jet. The water emerged slowly, in big shimmering low-gravity droplets that fell wi magical slowness to the floor, where suction pumps drew in every last precious molecule. Mikha lifted his face to the stream, trying to calm himself.

Thales said gently, "I've brewed some coffee, Mikhail."

"Thales, that was thoughtful."

"Everything is under control."

"Thank you . . ." Sometimes it really was as if Thales knew Mikhail's moods.

Thales was actually a less sophisticated clone of Aristotle, who was an intelligence emergent from hundred billion Earth-side computers of all sizes and the networks that linked them. A remo descendant of the search engines of the late twentieth century, Aristotle had become a great electron mind whose thoughts crackled like lightning across the wired-up face of the Earth; for years he ha been a constant companion to all humankind.

When humans had begun their permanent occupation of the Moon at Clavius Base, it had bee inconceivable that they should not take Aristotle with them. But it takes light more than a second travel from Earth to the Moon, and in an environment where death lurks a single error away, suc delays were unacceptably long. So Thales had been created, a lunar copy of Aristotle. Thales wa updated continually from Aristotle's great memory stores—but he was necessarily simpler than h parent, for the electronic nervous system laid across the Moon was still rudimentary compared to th Earth's.

Simpler or not, Thales did his job. He was certainly smart enough to justify the name he had bee given: Thales of Miletus, a sixth-century Greek, had been the first to suggest that the Moon shone n by its own light but by reflection from the sun—and, it was said, he had been the first man to predict solar eclipse.

For everybody on the Moon, Thales was always there. Often lonely despite his stoic determination, Mikhail had been soothed by Thales's measured, somewhat emotionless voice.

Right now, thinking wistfully of Eugene, he felt he needed soothing.

He knew that Eugene was based at Tsiolkovski. The huge Farside crater was host to an elabora underground facility. Buried in the still, cold Moon, undisturbed by tremors, shadowed from Earth

radio clamor and shielded from all radiation except for a little leakage from trace quantities in th lunar rocks, it was an ideal location for hunting neutrinos. Those ghost-like particles scooted throug most solid matter as if it weren't even there, thus providing unique data about such inaccessible plac as the center of the sun.

But how odd to come all the way to the Moon, and then to burrow into the regolith to do yo science, Mikhail thought. There were so many more glamorous places to work—such as the b planet-finder telescope array laid out in a North Pole crater, capable of resolving the surfaces of Eart like planets orbiting suns spread across fifty light-years.

He longed to discuss this with Eugene, to share something of his life, his impressions of the Moo But he knew he must keep his reactions to the younger man in appropriate categories.

Since his teens, when he had become fully aware of his sexuality, Mikhail had learned to master h reactions: even in the early twenty-first century, homosexuality was still something of a taboo Vladivostok. Discovering in himself a powerful intellect, Mikhail had thrown himself into work, an had grown used to a life lived largely alone. He had hoped that when he moved away from home, his career took him through the rest of the sprawling Eurasian Union as far as London and Paris, an then, at last, off the Earth entirely, he would find himself in more tolerant circles. Well, so he had; bu by then it seemed he had grown too used to his own company.

His life of almost monastic isolation had been broken by a few passionate, short-lived love affair But now, in his midforties, he was coming to accept the fact that he was never likely to find a partn to share his life. That didn't make him immune to feelings, however. Before today he had barel spoken two words to this handsome boy, Eugene, but that, evidently, had been enough to develop foolish crush.

He had to put it all aside, though. Whatever Eugene had come to Shackleton for, it wasn't fo Mikhail.

The end of the world, the boy had said. Frowning, Mikhail toweled himself dry.

5: Emergency Management

Siobhan was taken to the Council Room on the first floor of the Royal Society building. The room centerpiece was an oval conference table large enough to seat twenty or more, but Siobhan was alon

here save for Toby Pitt. She sat at the head of the table uncertainly. On the wall was a slightly surre Zulu tapestry, meant to show symbolically the rise of science, and portraits of former fellows—most dead white males, though the more recent animated images were more diverse.

Toby tapped at the table's polished surface, which turned transparent to reveal a bank of embedde softscreens. The screens lit up, variously showing scenes of disaster—crashes on the road and ra systems, raw sewage spilling from a pipe onto a beach somewhere, what looked horribly like th wreck of a plane plowed into a Heathrow runway—and concerned faces, most with softscreens in the backgrounds and earpieces clamped to their heads.

One serious-looking young woman seemed to be calling from a police control room. When sh caught Siobhan's eye, she nodded. "You're the astronomer."

"The Astronomer Royal, yes."

"Professor McGorran, my name is Phillippa Duflot." Perhaps in her early thirties, alarmingly we spoken, she wore a slightly disheveled business suit. "I work in the Mayor's office; I'm one of h PAs."

"The Mayor—"

"Of London. She asked me to find you."

"Why?"

"Because of the emergency, of course." Phillippa Duflot looked irritated, but she visibly calme herself; considering the strain she was evidently under, Siobhan thought, her self-control wa impressive. "I'm sorry," Phillippa said. "All this has hit us so suddenly, over the last couple of hou or less. We rehearse for the major contingencies we can think of, but we're struggling to cope toda Nobody anticipated the *scale* of this. We're trying to find our feet."

"Tell me how I can help you."

Formally Phillippa was calling on behalf of the London Resilience Forum. This was an interagenc body that had been set up following the upsurge in terrorism at the turn of the century. Chaired fro the Mayor's office, it contained representatives of the city's emergency services, transport, th utilities, the health services, and local government. There was a separate body responsible for Londo emergency planning, which also reported in to the Mayor. Above such local bodies were nationa emergency planning agencies, which reported to the Home Office.

Siobhan learned quickly that most of these agencies were talking shops. The real responsibility f emergency responses lay with the police, and right now the key figure in touch with the Mayor was chief constable. It was the way things were done in Britain, Siobhan gathered; there was a lack central control, but a local flexibility and responsiveness that generally worked well. But now th Britain was thoroughly integrated into the Eurasian Union there was also a Union-wide emergenc management agency, based on the Americans' FEMA, under whose auspices, some years earlie firefighters from London had been sent in response to a chemical plant disaster in Moscow.

And today this network of disaster management agencies was buzzing with bad news. London w afflicted by a whole series of interconnected problems, whose root cause Siobhan at first couldn guess at. Suddenly, all at once, everything was falling apart.

The most immediate problem was the collapse of the power grid. Phillippa bombarded Siobhan wi data on areas of brownout and blackout, and images of the consequences: here was an undergrou shopping mall in Brent Cross, its lights doused and elevators and escalators stalled, thousands people trapped in a darkness broken only by a ruddy emergency glow.

Phillippa looked doleful. “The very first call we logged today was from a man trapped in his hot room when the electronic lock jammed up. Since then it’s just mushroomed. Every transport syste has ground to a halt. People are stranded on planes ramped up on runways; others are trapped in plan that can’t land. We don’t even have numbers yet. We don’t dare think how many people are jus trapped in lifts!”

The power system was the problem. Electrical power originated in generating stations—these da mostly nuclear, wind-generated, tidal, and a few fossil-fuel-burning relics. The generators sent o rivers of current in transmission cables at high voltages, more than a hundred thousand volts. The were stopped down at local substations and transformers and sent out through more lines, eventual reaching the level of the few hundred volts that reached businesses and homes.

“And now it’s all failing,” Siobhan prompted.

“Now it’s failing.”

Phillippa showed Siobhan an image of a transformer, a unit as big as a house, shaking itself pieces as its core steel plates crashed and rattled. And here were power lines sagging, smoking, visib melting, and where they touched trees or other obstacles powerful arcs sparked fires.

This was called magnetostriction, Phillippa said. “The engineers know what’s happening. It’s ju that the GICs today are bigger than anything they’ve seen before.”

“Phillippa—what’s a *GIC*?”

“A geomagnetically induced current.” Phillippa eyed Siobhan with suspicion, as if she shouldn have had to explain; perhaps she wondered if she was wasting her time. “We’re in the middle of geomagnetic storm, Professor McGorran. A huge one. It came out of nowhere.”

A geomagnetic storm: of course, a storm from the sun, the same cause as the beautiful auror Siobhan, her brains clogged in the room’s gathering heat, felt dull not to have grasped this at once.

But her basic physics was coming back to her. A geomagnetic storm, a fluctuation of Earth magnetic field, would induce currents in power lines, which were simply long conductors. And as th induced currents would be direct, while the generated electrical supply was alternating, the syste would quickly be overwhelmed.

Phillippa said, “The generating companies are wheeling—”

“Wheeling?”

“Buying in capacity from outside. We have exchange deals with France, primarily. But the Frenc
are in trouble, too.”

“There must be some tolerance in the system,” Siobhan said.

“You’d be surprised,” Toby Pitt said. “For fifty years we have been growing our power demand
but have resisted building new power stations. Then you have market forces, which ensure that eve
component we do install barely has the capacity to do the job that’s asked of it—and all at the lowe
possible cost. So we have absolutely no resilience.” He coughed. “I’m sorry. A hobbyhorse of mine.”

“The worst single problem is the loss of air-conditioning,” Phillippa said grimly. “It isn’t even noo
yet.”

In a 2030s British midsummer, heat was a routine killer. “People must be dying,” Siobhan sai
wondering; it was the first time it had really struck her.

“Oh, yes,” Phillippa said. “The elderly, the very young, the frail. And we can’t get to them. W
don’t even know how many there are.”

Some of the softscreens flickered and went blank. This was the other side of the day’s problem
Phillippa said: communications and electronic systems of all kinds were going down.

“It’s the satellites,” she went on. “The comsats, navigation satellites, the lot—all taking a beatin
up there. Even land lines are failing.”

And as the world’s electronic interconnectedness broke down, the smart systems that we
embedded in everything, from planes to cars to buildings to clothes and even people’s bodies, were a
failing. That poor man stuck in his hotel room had only been the first. Commerce was grinding to
halt as electronic money systems failed: Siobhan watched a small riot outside a petrol station whe
credit implants were suddenly rejected. Only the most robust networks were surviving, such
government and military systems. The Royal Society building happened still to be connected
central services by old-fashioned fiber-optic cables, Siobhan learned; the venerable establishment ha
been saved by its own lack of investment in more modern facilities.

Siobhan said uncertainly, “And this is another symptom of the storm?”

“Oh, yes. While our priority is London, the emergency isn’t just local, or regional, or even nationa
From what we can tell—data links are crashing all over the place—it’s global . . .”

Siobhan was shown a view of the whole world, taken from a remote Earth resources satellite. Ov
the planet’s night side aurorae were painted in delicate, heartbreakingly beautiful swirls. But the wor
below was not so pretty. Darkened continents were outlined by the lights of the cities strung alon
their coasts and the major river valleys—but those necklaces of lights were broken. As each outag
triggered problems in neighboring regions, the blackouts were spreading like infections. Pow
utilities were in some places trying to help each other out, but, Phillippa said, there was conflic

Quebec was accusing New York of “stealing” some of its megawatts. In a few places Siobhan saw th ominous glows of fires.

All this in a couple of hours, Siobhan thought. How fragile the world is.

But the satellite imagery was full of hash, and at last it broke down altogether, leaving a pale blu screen.

“Well, this is dreadful. But what can I do?”

Phillippa again looked suspicious. *You need to ask?* “Professor McGorran, this is a geomagnet storm. Which is primarily caused by problems with the sun.”

“Oh. And so you called an astronomer.” Siobhan suppressed an urge to laugh. “Phillippa, I’m cosmologist. I haven’t even thought about the sun since my undergraduate days.”

Toby Pitt touched her arm. “But you’re the Astronomer Royal,” he said quietly. “They’re out o their depth. Who else are they going to call?”

Of course he was right. Siobhan had always wondered if her royal warrant, and the vague publ notoriety that came with it, was worth the trouble. The first Astronomers Royal, men like Flamstee and Halley, had run the observatory at Greenwich and had spent most of their time makin observations of the sun, Moon, and stars for use in navigation. Now, though, her job was to be figurehead at conferences like today’s, or an easy target for lazy journalists looking for a quote—an it seemed, an escape route for politicians in a crisis. She said to Toby, “Remind me to quit when this all over.”

He smiled. “But in the meantime . . .” He stood up. “Is there anything you need?”

“Coffee if you can get it, please. Water if not.” She raised her own phone to her face; she felt spasm of guilt that she hadn’t even noticed it had lost its signal. “And I need to speak to my mother she said. “Could you bring me a land line?”

“Of course.” He left the room.

Siobhan turned back to Phillippa. “All right. I’ll do my best. Keep the line open.”

6: Forecast