

Seveneres Study Guide

Seveneres by Neal Stephenson

(c)2016 BookRags, Inc. All rights reserved.



Contents

Sevenses Study Guide.....	1
Contents.....	2
Plot Summary.....	3
Section 1, Chapters 1—3.....	7
Section 2, Chapters 4—6.....	15
Section 3, Chapters 7—9.....	23
Section 4, Chapters 10—12.....	32
Section 5, Chapter 13—Epilogue.....	42
Characters.....	48
Symbols and Symbolism.....	54
Settings.....	57
Themes and Motifs.....	59
Styles.....	64
Quotes.....	66



Plot Summary

Seveneres is a speculative novel dramatizing humankind's effort to survive following the Moon's explosive fragmentation by some inexplicable agent. Astronomers estimate only two years remain before debris enters and burns away Earth's atmosphere, surface, oceans, and all life. The International Space Station, fitted with "arklets," populated with 1,500 people and the Human Genetic Archive, is the foundation around which the Cloud Ark will be constructed. The brain-trust is tasked by leaders to engineer a self-sustaining environment capable of maneuvering away from larger fragments, and withstanding 5,000 years in near-earth orbit until the planet is stable enough to be terraformed into supporting life. The project is designed also to engage those left behind, and prevent worldwide chaos.

In present-day Utah, an amateur astronomer notices a dusty blur near the Moon's equator, and is thrilled to blog about it on his phone. Before he can thumb the first key the Moon no longer exists. He and millions of others throughout the Americas witness the same chilling sight: a greater-than-moon-sized cloud which, after the dust settles, turns red. After that, 7 tumbling boulders still bound by gravity remain. World leaders in science, defense, and politics are mystified, referring to the causal Agent. No one knows, and the conspiracy-minded suspect extraterrestrial forces are responsible, but are not taken seriously. Scientists are confident the Agent will be identified.

In northern Alaska, miner Rufus MacQuarie sees the cataclysm from high atop the Brooks Range, and consults an app that displays current positions of both natural and man-made celestial objects. Checking for the International Space Station, he lashes to his knee a self-designed telegraph key and taps a message—LOOK AT THE MOON—to his daughter, Dinah, a roboticist on the ISS (known as "Izzy" to occupants). Dinah does this and, along with the rest of humanity, knows the universe is forever changed. Later (A+0.0.4: zero years, zero days, and four hours after the event) at a meeting in the ISS between Commander Ivy Xiao, Dinah, and the ten other crew members, German astronomer Konrad Barth theorizes that a Primordial Singularity, or small black hole, hit the moon like a bullet through an apple.

Dubois "Doob" Jerome Xavier Harris, Ph.D. observes the moon's destruction during a fund-raiser at Caltech Athenaeum. His role as TV's Dr. Harris—popularizer of science—asserts itself, and he soon is besieged with requests to "explain" why scientists missed the approaching "meteorite." His phrase "breakup of the moon" (not explosion) becomes popular on Twitter—hashtag #BUM. The largest moon fragments are named the Seven Sisters. Harris himself benignly names them Potato Head, Mr. Spinny, Acorn, Peach Pit, Scoop, Big Boy, and Kidney Bean. Scientists speculate these tremendous remnants will repeatedly collide and produce an infinite number of smaller material destined to enter Earth's atmosphere in approximately two years. They name the debris cloud "white sky," precursor to the unimaginable apocalypse of "hard rain" when the mass becomes super-heated bolides (bright fireballs) smashing into the planet and causing the oceans to boil away. In one week various star parties are given, during which the public and school buses full of children visit parks and make a game out of



identifying by shape and name the Seven Sisters. An optimistic theory circulates, claiming the moon's gravity will gradually draw together all the fragments, but vivid meteor showers seem to contradict this notion. At a Caltech campus party, Dr. Harris meets elementary school teacher Amelia Hinojosa, and they fall in love.

Dr. Harris meets with U.S. president Julia Bliss Flaherty, and tells her it's crucial to stop asking what happened, and start talking about what's going to happen. It is decided that the only places anyone might survive are in space, or deep underground. An ad hoc committee of spacefaring nations establishes a project of immense scale: the International Space Station will serve as the hub around which will be constructed a Cloud Ark consisting of hundreds of "arklets," prefabricated "cans" rotating in pairs for artificial gravity. These will support the last people to escape Old Earth, as well as the vital Human Genetic Archive. The ISS is attached to a captured Arjuna (near-Earth) asteroid, Almathea, which is being mined for nickel and iron by Dinah MacQuarie's robots. It is decided these metals can be smelted and used to produce building materials. The President's Science Adviser, Dr. Pete Starling, is as devastated as everyone else when informed that the Cloud Ark must be self-sustaining for 5,000 to 10,000 years. Entrepreneur Sean Probst, Dinah's boss, founder and chairman of Arjuna Expeditions, plans to head an operation to capture and bring back to ISS a comet—Grigg-Skjellerup ("Greg's Skeleton")—formed of ice, which will provide drinking water and can be used as a propellant for "Izzy's" thrusters. The mission will require a small nuclear reactor. Latent radioactivity in the spacecraft's fuel rods will convert comet ice into steam.

Authorities on Earth, including NASA, paint the moon's destruction with false sentiment and "cute" terms. The public is urged to assist the Cloud Ark project, but are not aware that only 1,500 people ultimately will be selected by a supposed Casting of Lots; the mass activity is designed to assuage despair and lessen chances of rioting and other violence. The predicted "hard rain" starts 701 days after the moon's shattering, and Earth's surface is annihilated. Dinah's father, Rufus MacQuarie, and some others have made one of his company's Alaska mines into a well-equipped fortress. Ivy Xiao's fiancé, Navy submarine commander Cal Blankenship, has headed with his crew for a deep-sea trench. None—including government/military leaders in vast subterranean holdouts—are expected to survive.

The greatly enhanced ISS crew, most of whom occupy arklets, have little time to carry out final communications with loved ones and must maneuver the Cloud Ark away from debris as well as deal with last-minute "stragglers" (the U.S. president, Julia Bliss Flaherty, among them) who managed to launch into space during the brief "white sky" period. On the ground, doomed people gather in places of worship and elsewhere, while choirs and orchestras are broadcast over the sizzling airwaves until silenced by the deadly bolides.

Not long after, Swiss astronaut Markus Leuker replaces Ivy as commander of the Ark, and announces that all political/national allegiances no longer hold, and declares what amounts to martial law pursuant to the Crater Lake Accord—a sort of new Constitution prepared on Earth during the massive production of materials in Seattle. As a



contingency/safety measure, the Ark as yet has no command center. Any tablet (accessed with the correct password) can be used to control the station's thrusters, and network specialists design social media platforms: Scape, for video-conferencing; Spacebook for more recreational matters; and a cell-phone system. Political concerns manifest as they did in earthbound times, and three factions emerge.

Swarmamentalists, who want "pure swarm," i.e., the genetics lab and materials distributed among the arklets, which would then collectively move to a higher orbit relatively safe from lunar debris. A second group holds a "Dump and Run" perspective—jettison most of the attached asteroid (Amalthea), and robotically hollow out the remainder into a protective human nest. The third faction—the Big Ride—is most ambitious: boost the station and Amalthea to a much higher orbit, and feed off the icy comet Sean Probst's mission promises to deliver. The ultimate, permanent, destination is a massive iron moon remnant scored with a Grand Canyon-sized zone named Cleft. There, no latent debris or ubiquitous micrometeoroids can penetrate, and humankind can start over.

When former U.S. President Julia Flaherty recovers from a harrowing (and illegal) docking with the Ark, her assertive temperament and ideas attract followers, and yet another group is formed: those who have hoarded supplies into a handful of arklets and plan to colonize Mars. Sean Probst's Ymir spacecraft completes a half-year journey to capture the "Greg's Skeleton" comet. He manages to head the operation toward the Ark, and he and his six-person crew perish from radiation poisoning. In a Modular Improvised Vehicle (MIV) christened New Caird, Markus, Dinah, nuclear engineer Jiro Suzuki, and Vyacheslav Dubsky are able to dock with the ghost ship Ymir and ascertain it is on course to orbit with the Cloud Ark. Dinah is the sole survivor of this mission, but now the Ark is assured of water for propellant and drinking. Julia Flaherty and most of the station's occupants abandon the vessel, head off in arklets to a safer orbit, and start the long journey toward Mars. After so much death, division, and brutal hardship, those remaining on the Ark rechristen it as Endurance.

After Endurance (formerly the ISS) is fitted with the immense ice "splinter" captured by tragically heroic Sean Probst and his crew, the new mass burdens the projected one-year, 300,000-mile journey to Cleft into three years. Only nine people survive, and Dr. "Doob" Harris dies after a final "moon-walk." The surviving eight are all women, and hold a meeting—the Council of the Seven Eves—to decide whether to continue existing. They are called the Seven due to Luisa's having passed menopause. With the Human Genetic Archive gone, Moira explains that, using automictic parthenogenesis, uniparental embryos can be created out of normal eggs. Thus—barring further catastrophe—the human race will be reborn.

After 5,000 years, several billion people (descended from the Seven Eves: Dinah, Ivy, Moira, Camila, Julia, Tekla, Aida) live in the Great Chain, a ring of orbiting habitats. Members of Survey and Snake Eaters are tasked with monitoring and reporting on the growth of New Earth's ecosystem which, after millennia of seeding using manipulated DNA preserved from Old Earth and oceans replaced with melted comet ice, is nearly ready for human reoccupation. Some, whose DNA was repurposed long ago by Eve Moira, are capable of epigenetic adaptation. More conservative inhabitants, Amistics,



are ambivalent about constantly evolving technology. Primarily, humankind is divided into two factions: Blue, aligned with the traditions of Endurance, and Red, following Swarm beliefs and philosophies. In spite of treaties, a group labeled as Sooners take it upon themselves to relocate to Earth. Further problems arise when reports of anomalous people on Earth spark the creation of Seven, an investigatory group comprised of one member from each of the new human races. It is discovered that some people, well-prepared in the two years following the moon's disintegration, survived. Diggers (descended from Eve Dinah's father), who built underground holdouts; and Pingers (descended from Eve Ivy's fiancé), who guided submarines into the deepest undersea canyons. These survivors evolved into two races, the Pingers capable of underwater exploration, where the ejecta of "Spacers" are discovered.

The orbiting human races fight over exclusivity of contact with the survivors, and discover means of communication with them. Once established, more conflict manifests from the Diggers. At length, it is understood that yet further disagreements and even violence will forever mark the races of humankind, wherever they may travel.



Section 1, Chapters 1—3

Summary

Seveneves, by Neal Stephenson, is an epic science-fiction novel chronicling humankind's struggle to survive after a mysterious astronomical event fragmentizes the Moon.

Chapter 1 opens in present-day Utah, where an amateur astronomer observes a dust-cloud near the Moon's equator. He takes his cell phone from a pocket to blog about what he takes as a meteor strike. Before he can key the first letter, the moon is shattered. Several hours later, after the dust is pulled back by the still-existing gravity between seven tremendous remnants, people in North and South America see a red blur in the dawn sky. Around the world, confused scientists can only theorize about the event, and simply refer to what might have caused it as the Agent.

In Chapter 2, Alaskan mine operator Rufus MacQuarie witnesses the catastrophe unfold over the ridge-line of the Brooks Range, and straps to his leg an antique telegraph key of his own design. He taps out a message to his daughter, Dinah, a roboticist on the International Space Station, advising her to look at the moon. Rufus uses the old low-tech method because it bypasses Internet bandwidth and ensures privacy. Dinah designs, builds, and codes various robots employed to mine asteroid Amalthea of nickel and iron while bolted to the station. Dubois Jerome Xavier Harris, Ph.D. ("Doob") sees the moon's destruction from a fundraising reception in the courtyard of the Caltech Athenaeum. As a TV personality who explains science to the public, Doob becomes a media liaison, known on TV and to 4,000,000 Twitter followers as Doc Dubois.

Ivy Xiao, overall commander of the ISS, has the "motor control of a chopper pilot and the mathematical mind of a physicist." This usually intimidates others, but means nothing four hours after the moon event at an emergency meeting in the Banana (longest uninterrupted section in the spinning torus) with Dinah and the 10 other crew members. Various screens show live video of the human reaction on Earth, and provide teleconferencing with Houston, Baikonur (Russian launch facilities), or Washington. Ivy explains the tides won't be affected because the moon's mass—and gravitational center—is still there, and the Sun actually has greater influence. NASA's deputy administrator, Aurelia Mackey, warns the ISS crew to expect debris impacts, and to "batten down the hatches." The crew must divide Izzy into discrete sections, so any depressurization won't compromise station integrity. All spaceflight operations are suspended.

Ivy and Dinah close themselves in Ivy's tiny "office," and over tequila tearfully discuss how the lunar impact event might affect Ivy's wedding plans, particularly her Morg's (maternal organism) role. Dinah will send her earthbound father raw data files from Konrad Barth's Wide-Field Infrared Observation Platform, this time using the Internet. On Earth, Doc Dubois spends the next week addressing the public. Dubois spins the



catastrophe as a fascinating event that didn't kill anyone beyond rubbernecking drivers who lost control of their vehicles, but he is soon forced to amend that claim.

After this revelation, Dubois maintains a website where anyone can view a high-resolution feed of the debris cloud. The big fragments are called the Seven Sisters, but Dubois removes their frightening aura by naming them Potatohead, Mr. Spinny, Acorn, Peach Pit, Scoop, Big Boy, and Kidney Bean. At a Caltech star-gazing party hosted by Dubois, he meets, and falls in love with, his future wife: an elementary school teacher, Amelia Hinojosa.

Chapter 3 begins with Doc Dubois at Camp David, presenting Julia Bliss Flaherty (President of the United States), science adviser Pete Starling, the Chairman of the Joint Chiefs of Staff, and a number of Cabinet members with a grim scenario. Dubois' presentation clearly points out that debris collision (or Bolide Fragmentation Rate) will increase exponentially. His grad students are busily crunching numbers, and eventually, trillions of meteor falls will super-heat the atmosphere, boil away the oceans, and incinerate all life. Only two places offer questionable refuge: underground holdouts, and outer space. Dubois expects the duration of the assault to last between 5,000 and 10,000 years.

President Flaherty later teleconferences with the ISS's crew of 12, and in no uncertain terms tells them they will never again set foot on terra firma, touch loved ones, or breathe the atmosphere of their mother planet. Astronomer Konrad Barth asks to speak to Doc Dubois, and demands confirmation of the grim data. JBF cuts in and declares that the Chinese figured it out before the U.S., and Dubois' calculations have more or less been confirmed by the UK, India, France, Germany, Russia, and Japan. White Sky very probably will manifest within 25 months. JBF adds that she, the people of the United States, and of Earth, need the crew, because talks have ensued with other space-faring nations about creating an "ark," to preserve the entire genetic heritage of the Earth. This monumental project must be designed and constructed within two years. Finally, Ivy (who has been told her fiancé—U.S. Navy commander Cal Blankenship—has received the same death sentence as the rest of the world) speaks up, telling JBF that Izzy cannot support new occupants. Dubois explains the Cloud Ark project; ISS serving as the hub around which hundreds of quickly mass-produced "arklets" will swarm and house the many specialists required.

Scott "Sparky" Spalding, NASA director, takes over and reports that a Canadian electrical engineer and an American communications specialist will establish the network infrastructure needed to support the Cloud Ark project. The preparation for incoming modules (arklets) will be handled by a Russian space-walk veteran and an American expert on space suits. The four life scientists chosen represented the U.S., Australia, Japan, and Italy will study the effects on the human body of spaceflight, cosmic rays, and the practical running of life-support systems. Sparky assigns 11 of the original ISS crew to assist—except Dinah. Dinah tells the director not to let NASA ditch Amalthea and cut up the robots for spare parts, reminding him that the station must be maintained for thousands of years. Director Spalding promises to guard her interests.



Two weeks after the Agent hit the moon, Ivy, Konrad, and Lina had been slated to return to Earth, their scheduled replacements two Russians and a British engineer. On A+0.17. (Day 17 after Agent), a Soyuz craft safely docks at the station's Hub module. Dinah must greet whoever is on the Soyuz capsule, and is mildly surprised by the appearance of cosmonaut Maxim Koshelev and Bolor-Erdene. The Russians, Dinah notes, have ridden up in a part of the capsule not designed for humans, and is shocked again to find the originally scheduled cosmonauts and Englishman, Rhys Aitken unstrapping themselves from proper acceleration couches.

Doc Dubois stands behind President Julia Bliss Flaherty as she reads from a teleprompter, and is glad he isn't charged with telling the world it's going to die. The only things, and people, with a chance of survival were those already in orbit and those soon to be. The address to the world takes place at Crater Lake, Oregon, before the lodge commandeered by the State Department. During the announcement, a bolide makes a fleeting hypersonic pass and breaks into fragments before vanishing over the horizon.

Sadly, there are only a certain number of people qualified to go on space-walks or assemble rocket engines, and those had already been mobilized. Still, there were ways anyone could help the Cloud Ark project, not all of them purely technical. World leaders know they must keep a doomed population busy in order to prevent rioting and other chaos.

On the ISS, Dinah MacQuarie is grateful not to have been on the ground when the Crater Lake announcement had been made. From her small shop she gazes past the craggy form of Amalthea onto the Earth's blue curve, where seven billion people are undergoing collective emotional trauma unknown in humankind's history. A Morse-code message from her father comes in from Alaska: he's proud that she's up on ISS. Rhys abruptly appears, and annoys Dinah by asking questions about her role with billionaire Sean Probst's latest Arjuna Expeditions project. Dinah admits she is testing robots for work in ice and after a few minutes of conversation, their instincts take over and they have sex.

One week later, the Russians begin arriving to make preparations for expansion of ISS. An ad hoc working group of governmental space agency veterans and commercial space entrepreneurs—like Sean Probst and his Arjuna Expeditions—had figured a decentralized design could work. The "arklets," already in mass production at various terrestrial factories, are compact enough to be attached atop heavy-lift rockets, and eventually would be powered by small simple nuclear reactors so radioactive that they would provide heat and electricity for decades. Each arklet will house five to ten people, and must protect against vacuum, cosmic radiation, and micrometeoroids. Worse, the whole Cloud Ark must become self-sustaining: oxygen from growing plants, recycled carbon dioxide to feed the plants and vegetables, water from (hopefully) Sean Probst's soon-to-be captured comet.

As time pushes on, Dinah notices the "Arkitects" keep changing their plans, the apparent "best" being "fully distributed," where the Cloud Ark would have no central depot, and exchanges of material and people would materialize via "opportunistic



docking." Scouts, sent up by the Arkitects, and able to withstand inhuman levels of physical endurance, will be spending 16 hours each day inside Orlan space suits.

Dinah's work-shop window is now blocked by the Russians' balloon-like Luks (survival devices) cabled to the asteroid Amalthea, but considering the risks being taken by the Russians, she doesn't mind. The closest Luk houses a woman whose blurred form can be seen through its translucent layers. A search of NASA websites reveals the woman's name: Tekla Alekseyevna Ilyushina, test pilot and former Olympic athlete. Rhys and Ivy too become fascinated with the woman, and indulge voyeuristic urges usually while Tekla is sleeping after 16-hour shifts. Dinah writes her e-mail address on a chocolate bar wrapper and has one of her robots deliver the treat to the airlock of Tekla's Luk. Tekla seems to like this, but indicates she has no e-mail capability. Since all astronauts (and cosmonauts) must know Morse code, Dinah uses this to open communication beyond the visual.

On Day 37 after Zero, Ivy holds a meeting of all crew with "Sparky" (NASA administrator), Pete Starling (Presidential science adviser), and a Swedish woman—Ulrika Ek—who is the new Arkitect-in-chief, and informs them they have used 5% of the estimated two years until Hard Rain destroys all contact with Earth. The station must be transformed into a society and ecosystem sustainable indefinitely. Fyodor declares he needs more Scouts before the Pioneers arrive in two weeks. Dinah's newest work is on robotic ice-crawlers and tunnelers, but she has vowed to not cease tinkering with her iron-mining units.

With Rhys' help, Dinah uses her Grabb and Siwi (sidewinder) robots to form a chain around Tekla's Luk, and pull it flush with an airlock opening onto the SCRUM (Space Commercial Resources Utility Module). On screen, Tekla smashes into the airlock and is reduced to a bloody fetal position. With the Big Hoover howling in the not-completely-closed airlock, Tekla is carried into the station. Alarms are sounding, and people in Houston and Russia are angry. Soon after, Tekla stoically declares that she will be in trouble merely because others rescued her from certain death.

Analysis

The inciting incident, in narrative plot structure, refers to the event that sets the story in motion. This event is the catalyst that causes the protagonist(s) to act. In Neal Stephenson's *Seveneves*, the inciting incident is established in the first line: "The moon blew up without warning and for no apparent reason." The dissolution of the moon is the event that foreshadows the annihilation of humankind and establishes the need to preserve humanity by any means necessary.

The amateur astronomer taking out his cell phone to blog about the mysterious dust cloud on the moon is an example of Stephenson's cutting social observation and wit. The irony of this scenario is that what appears to be the amateur astronomer's claim to fame turns out to be his death sentence – as well as the death sentence for most of mankind. Before the young man even can begin thumbing keys, the moon no longer



exists. In a single brief scene, the author has commented on how social media often removes users from reality happening right before their eyes, and on the shocking speed and scale of violent astronomical events. Soon after, scientists and everyone else around the world are terrified and baffled by the moon's becoming a blurry red cloud swelling by the hour.

Likewise, this opening scene also establishes key symbolism in the narrative. A symbol of fierce power and mythically charged, the moon literally and metaphorically looms over *Sevneves*. Its centrality to the plot is established in the first line of the novel and continues throughout. The moon can be seen to represent femininity, mystery, and the subconscious. In *Sevneves*, the loss of the moon foretells the doom of Earth and its inhabitants. It can therefore be derived that without balance of the feminine and masculine, of logic and emotion, that humanity faces certain doom. As the novel progresses and more and more conflicts arise between the surviving factions, this symbolism proves true.

Another example of foreshadowing in the novel's beginning appears with the introduction of mine owner Rufus MacQuarie, who bears witness to the moon's disintegration and uses an antique telegraph key to tap Morse code messages to daughter Dinah on the International Space Station. Immediately the reader understands Rufus is not a conventional blue-collar type, but is sharply intelligent, realizing that his antique telegraph is more efficient than the Internet which relies on shared bandwidth. It is this ingenuity and acuity that will later serve Rufus when he establishes underground shelter from the fallout and ultimately forms a new society and human race.

The character of Doctor Dubois is introduced while attending a Caltech fundraiser, where he sees the implosion of the moon, believing at first that it is some kind of elaborate special-effects trick. Doctor Dubois' character, as a TV popularizer of science, is reflective of popular contemporary television personalities Neil deGrasse Tyson and Bill Nye. The fact that Dubois meets and falls in love with his future wife at the same time that humanity faces its demise is both ironic and heartbreaking.

At a global teleconference on the International Space Station, no one has an answer to what smashed the moon. German astronomer Konrad Barth cites the 1908 Tunguska explosion and suggests a black hole may be responsible for the moon's implosion. The Tunguska event is a much-speculated about phenomenon, often attributed to impact from a meteor, though no impact crater has been found. The author's historical allusion to this event highlights both the power of nature and man's constant struggle to divine and understand the forces around us.

Two major themes in the novel are introduced in this section of the book as well. The theme of survival is established early on, as scientists and world leaders struggle to make sense of the moon's fragmentation and what this event means for Earth and humankind. Once it is determined that *Hard Rain* will likely wipe out all humanity on the planet, desperate attempts are made to preserve the future of the species. The resulting mission to establish colonies attached to the ISS introduces the theme of exploration. Ultimately, the protagonists in *Sevneves* are forced to explore in order to survive.



The crew on the ISS is warned to batten down the hatches, and the author shows the emotional trauma that the characters face, especially in Commander Ivy Xiao, whose wedding plans must be canceled, and who knows she will never see her future husband again. The reaction of the ISS crew is only slightly less pronounced than that of the earthbound masses, and this foreshadows their gradual passage through numb horror into nearly clinical detachment long before loved ones are snuffed out by the falling lunar debris. This narrative approach aligns with the author's intent to portray as realistically as possible the reactions of people under constant stress, and a high level of uncertainty.

At Camp David, President Julia Bliss Flaherty's reaction to the grim presentation given by Dr. Dubois reveals little fear, a symptom of her inner turmoil. This foreshadows Flaherty's eventual descent into madness and her repeated attempts to control and manipulate. The reader observes Dubois' struggle against displaying genuine feelings, to put on a good show for the U.S. leader and her acolytes, and can foresee the beginnings of a pawn-like relationship.

Social media is bombarding Dubois, who already has millions of Twitter followers. Conspiracy theories circulate, all of them as ill-informed and absurd as those on the Internet every day. This is managed by the author without obvious and easy satire, because for the characters nothing is funny, and probably will be never again. NASA's public relations team naming the seven largest moon fragments with cute names captures real-world trivializing of threatening objects and ideas, a habit undoubtedly learned from annoying and dehumanizing Internet trends.

The Crater Lake announcement to the world by global leaders shows media manipulation at its best, and worst. The rugged, snowy mountains and green trees rising beyond the crater's clear blue bowl symbolize nature rebounding after a catastrophe. The luxurious lodge on the rim represents decadent isolation, exactly what these politicians wish to revisit. It is easy to criticize these characters' baser motivations, especially given the doom-laden scenario in which they're displayed. Here again, the author avoids the easy path of portraying politicians, celebrities, and media types one and all as shallow, self-absorbed "players." Some, of course, are exactly that; exploiting even the coming apocalypse for whatever might be gained during Earth's final act. Others are stripped to their essence, and react with common human despair.

Biblical allusion is strewn throughout *Seveneves*, from the title of the novel to its essential plot of rebirth. The names "White Sky" and "Hard Rain" allude to the Biblical flood, and it is thus fitting that the space colony to be established is named the "Ark." As the story unfolds, this metaphor expands with humanity's rebirth via the Seven Eves.

The concept of the "Ark" is introduced to the public to give hope and direction and to prevent mass pandemonium in the face of impending doom. This project, involving the building and launching of "arklets" to support at least 1,500 people, is vaguely revealed and the earthbound public believes there will be room for many, many more. Here narrative tension is very high, and empathy ever dwindling in the characters, when Russian cosmonaut and former Olympian—now reduced to expendable worker—Tekla



is rescued from an airlock accident by Ivy and Dinah. This selfless action angers Russian and American authorities, who have no qualms stressing Tekla's (hence all "hired help") relative value as unworthy of the potential danger/infrastructure damage her rescue might have caused. In their survival-at-all costs perspective, the authorities are "right." But the scene shows this policy from both sides, and Tekla herself expresses some ambiguity over being saved, exemplifying the dehumanizing stance of her employers.

The relationships between the different nationalities and ethnicities aboard the ISS are another example of foreshadowing in this section. Following the Earth's demise, the Ark population engages in a sort of Cold War, and these conflicts and events are hinted at through the characterizations in Part 1 of President Julia Bliss Flaherty, Secretary of the Interior Mary Bulinski, geneticist Clarence Crouch, ISS Commander Ivy Xiao, and the other world and space station leaders.

The motif of femininity, symbolized by the moon, is again revisited as plans solidify for the Cloud Ark project. Dubois realizes the possibility that cosmic radiation might destroy much of the collected (and frozen) eggs and sperm, and that enough willing young women would consent to impregnation. There would not be another generation of functional uteri for 14 or 15 years; a second generation in 30. By then, much of the frozen materials would be expired. The Cloud Ark will need mostly women, and not simply for carrying babies. Research shows they are less susceptible than men to radiation damage, and being usually smaller requires less space, food, and air. Also, they seem more capable of psychologically weathering being crammed together in tight spaces for extended periods.

The settings established in Section 1 are divergent from the remainder of the novel. Here, the author establishes two basic settings: the contemporary Earth and the International Space Station. After the event that caused the fragmentation of the moon, life on Earth changes forever. The ISS, meanwhile, is a real-world place, and author Stephenson chronicles its ever-expanding properties by a global collective of engineers, astronauts, cosmonauts, taikonauts, space workers and bureaucrats, in astonishing detail as it evolves into the Cloud Ark Swarm.

Dinah's obsession with the mysterious test pilot and former Olympic athlete Tekla Alekseyevna Ilyushina foreshadows several events and circumstances. Both in Dinah's relationship with Rhys and in their voyeuristic impulses regarding the Slav, the reader gains a sense of the sexual atmosphere that develops as mankind faces inevitable doom. Indeed, following the announcements regarding the fate of the planet, internet buzz from Earth claims recreational sex is the favorite pastime. Dinah's obsession also foreshadows her rescue of Tekla from the Luk bank which occurs in the end of Chapter 6.



Discussion Question 1

Author Neal Stephenson never reveals the nature of the "Agent" that disintegrates the moon. What do you think of this decision? Discuss what might have prompted him to sustain the enigma.

Discussion Question 2

NASA's public relations team quickly brands the visible moon fragments with cute names (Big Boy, Mr. Spinny, etc.) in order to lessen mass anxiety. Readers see frequent examples of this in real-world media. Do you think this sort of approach is necessary? Is the general population as vulnerable as media pundits seem to believe?

Discussion Question 3

ISS Commander Ivy Xiao provokes the anger of Russian authorities when she approves a plan—and is directly involved—to save the life of Tekla. The authorities claim this reckless act was a selfish and expensive waste of precious resources better saved for the greater good. What do you think of this decision? Consider the situation carefully before answering.

Vocabulary

meteorite, tawny, hypothesis, primordial, constellation, martial, sublunary, gamma, ridgeline, celestial, contraption, token, conduit, terabyte, montage, exponential, singsongy, torus, photovoltaic, inaugural, petechiae



Section 2, Chapters 4—6

Summary

Chapter 4 begins on Day A+0.56. Dinah and Rhys are enjoying frequent sex, but spend every other moment working to exhaustion and beyond. Larz Hoedemaeker at Arjuna Expeditions HQ sends Dinah a demo video of her Ice Nat robots; the time-lapse demo shows hundreds of the Nats scaling an ice block, tunneling, and breaking down the mass—as Dinah has designed them to do for Arjuna's founder, Sean Probst. On Earth, spacecraft, space suits, rocket boosters, and millions of specialized parts are being quickly produced via a global collective. Dinah picks up two assistants: Bo, an exotic Mongol woman; and Larz, the young bearded Dutchman who set up and filmed the Ice Nats demo. This is enjoyable for Dinah, who hasn't had a face-to-face conversation with a colleague in a year.

Dinah shows off her "Grimmed" (hardened and modified) robots. She has been employing otherwise idle units to make armor for other robots, using rough-hewn metal from Amalthea's surface. Larz explains how small, extremely "hot" radioisotope thermo-electric generators will be used to speed up the process of bringing in an icy-core comet from the sun's orbit. Dinah notices that all of Larz's incoming Arjuna e-mail is encrypted, and he deciphers them using a lot of paper and handwritten code. One of these messages informs him that his boss—entrepreneur Sean Probst—is coming up to Izzy in a "Drop Top."

Pulling off his helmet, Sean Probst's first words are "This whole thing is bullshit." Sean's thick glasses and unshaven look lend him a science-nerd air, until he speaks and displays smoldering intelligence and boundless ambition. Commander Ivy Xiao asks Dinah if she knew Sean was coming to Izzy, and tells Sean to say he had permission to join the crew. On a whiteboard in the Banana ("mission control"), Sean reveals the project's gravest fault: as soon as the Cloud Ark runs out of propellant, it loses the ability to do all of the things that make it a viable architecture for long-term survival. Sean concludes with the reasoning behind the comet-catching mission: with water, the Arkers can make hydrogen peroxide—a fine thruster propellant—or they can split it into hydrogen and oxygen to run big engines. Sean declares his asteroid-mining company has already identified icy comet cores in easy-to-reach orbits and asks Dinah to give him all of her robots.

Later, with Dinah in her work shop, Sean reveals that the comet-core mission is, in fact, going to happen. He and a small crew will be going after "Greg's Skeleton." Dinah knows of the comet; Sean informs her it is roughly 18 miles in diameter, and will provide an incalculable amount of water for fuel production. On A+0.73, Dr. Dubois flies into Seattle, rents an SUV, and drives to the campus of the University of Washington. He notices the newly expensive camping gear people are hoarding, and purchases some of his own, despite that he and all others know nothing will protect them from Hard Rain.



Henry, Dr. Dubois' son, wants to share an idea with his father. He and six others pack the SUV with belongings, and end up in a 20-vehicle caravan headed east out of Seattle. Sometime after midnight, Dubois' SUV exits the interstate at the town of Moses Lake, where the group (and many others) pitch tents for the night. In the morning, Dubois renames the place New Baikonur; it is newly occupied by nomads, "Space Okies," perhaps 10,000 of them digging trench latrines, putting up tents, and observing the tremendous activity visible all across the dry lake-bed of the decommissioned air force base. A concrete launch pad is being poured, and a large rocket built. Only four days later, Dubois drinks beer with space rednecks celebrating the rocket lift-off.

On Izzy, soon to become the Cloud Ark, the newest Arker watches a YouTube presentation featuring Dr. Dubois and journalist Tavistock Prowse as Dubois explains the massive operation at the Moses Lake spaceport. Doc Dubois reports on the controversial events surrounding Sean Probst's Arjuna Expeditions launches, asteroid mining, and the role of Our Heritage. Before watching Part 2 of Dubois' video, Luisa turns and asks Dinah if she works for Arjuna; Dinah half-jokingly silences her. Luisa mentions she heard Sean's name for the comet is Ymir, the Norse word for primordial ice giants, and wonders aloud how he will go about reaching, and retrieving, the massive object.

Day 90 "dawns," and with people having arrived from the "shake-and-bake" operations at Moses Lake spaceport, no one knows precisely Izzy's population. President Flaherty's Science Advisor, Pete Starling, has threatened to seize Moses Lake, until Sean Probst's counter-threat to make a YouTube video "exposing the Cloud Ark scheme as a poorly conceived panacea at best."

Astronomer Konrad Barth visits Dinah's shop, and nervously asks if she knows anything about the Ymir mission. Before she can answer, Barth takes out his tablet which shows an image of a cylindrical spacecraft and regards Dinah as if suspecting she knows a lot about this odd-looking contrivance. Barth details what Dinah already knows: Sean had gotten hold of a 4-gigawatt core from a large nuclear power plant, quickly re-engineered it, and had it placed for optimal insertion into the comet. After several days, Ymir's communications go silent. As of Day 140—two weeks after Ymir ought to have passed through L1—no sign can be seen she's on the return leg. Sean and the other six crew members, if alive to carry out the burn, would have nothing to do for a year but float in zero gravity.

On Day A+0.144, Ivy holds a meeting and informs everyone that they've reached the 20% point. White Sky will likely happen on or near A+1.354. The purpose of the Scouts who had begun arriving on Day 29 had been to build around the International Space Station an improvised network of tubes, connectors, and docking ports to accommodate the larger group of Pioneers. The Cloud Ark resembles a "freakin' three-dimensional domino game," according to Luisa.

Ivy and Dinah one day sit drinking liquor shots, an increasingly rare luxury infrequently replenished by new arrivals. Ivy admits she's glad Dinah was able to get on Sean



Probst's positive side, especially after Tekla's attack and Fyodor proposing to arrest all Arjuna personnel and confiscate whatever they'd brought from the ground.

In Chapter 5, between Day A+0.144 to 250, it becomes apparent that relying on truss sections fabricated on Earth and lifted into orbit to be slammed onto Izzy cannot last much longer. The Arkers must figure how to smelt iron and other metals from Amalthea and future captured asteroids. Surprisingly, an extremely useful truss-building system is discovered; almost a primitive thing. On Day A+0.247, an optimized 3-D printer arrives capable of modifying the angle at which beams can be inserted. Fyodor has an electron-beam welder for use in zero-gee and a vacuum which he has trained Vyacheslav Dubsky, Tekla, and two other spacewalkers to use. The four workers make numerous welds, and soon the reboost burns quit rattling and popping the hull. New docking ports sprout for the next stage: the arrival of the arklets.

Meanwhile, Earth's populace is living its second-to-the-last August ever. Around Day 260, reconditioned spaceports are operating, and now eight around the world are launching three types of arklet. U.S. President Julia Bliss Flaherty coldly states that Dubois is being asked to fly up and join the Cloud Ark population on or about Day 360. He blurts out that he doesn't want to go, and is horrified at both the proposal and his own complete loss of emotional control. The President makes clear that she herself is prohibited, under the Crater Lake Accord, to go into space and live, as are all national leaders and their families. Science Adviser Pete Starling's expression telegraphs he too doesn't believe in the project but that he needs Doc Dubois to go up there and lie for him.

The plan is for Dubois to be embedded within the Arkers, report on their daily lives, and give a sense of continuity. Finally, he says he'll do it. He now wants very much to go into orbit and—like Sean—find some way to be useful. Dubois asks the President to allow him three months with wife Amelia, and to take into space the frozen embryo of their future child. She agrees.

On Day 287 (some 433 days till Hard Rain), Dinah suspects that Rufus and his group are prepping to survive Hard Rain; Ivy suspects the same about her fiancé, Cal, commander of a nuclear submarine designed to ride out global thermonuclear warfare. Ivy thinks that if the deepest ocean trenches survive the boiling away of the surface water, a submarine crew might make it through Hard Rain. Ivy reveals that Earth's populace has made Arkers into reality TV characters, and are curious about Uppity Little Shitkicker—Dinah. Also, Tekla porn is popular. Ivy herself is referred to by viewers as "the uptight bitch who can't handle it."

Chapter 6 begins on Earth with Doc Dubois tracks the slow disintegration of the moon fragments with spreadsheets and plots his graduate students share. An important element is the BFR, Bolide Fragmentation Rate, a gauge of the rate at which big rocks became—via collision—small rocks. Dubois and Amelia check into a suite at the Langham, a palatial hotel in Pasadena, for a few days together before Dubois' round-the-world journey. Seventy-two hours later, inside a Navy helicopter, Dubois and several others touch down in Bhutan to attend a ceremony from which a boy and a girl will be



picked up to join the Cloud Ark. Cutting through Himalayan mist, Dubois worries whether the mass-produced arklets (sized like railway tank cars) will be able actually to sustain five people. After the spinning of prayer wheels and chiming of bells, ornately attired Dorji and Jigme are bid farewell.

On Day 306, the first bolo (two arklets connected by a cable, and revolving around a common center to make simulated gravity) coupling takes place. Ivy is installed in one arklet with passenger Dinah as general assistant. The other craft is controlled by recent arrival Markus Leuker, Swiss air force pilot/astronaut and veteran of two previous missions to the ISS. His assistant is Wang Fuhua, one of the first Chinese taikonauts to have reached Izzy during the deadly Pioneer days. The coupled arklets spin, and soon weak gravity can be felt. The Houston engineer calls out congratulations to Bolo One for "the first autonomously driven coupling of two spacecraft to create a rotating system for production of Earth-normal simulated gravity."

On Day 333, the journey to Moses Lake with Henry has converted Dubois, and he owns lots of state-of-the-art gear he's eager to use. He had returned home to Los Angeles with the idea he needed to get some of his own native soil on himself before getting shot up to a place where he would be as lost and alienated as Dorji and Jigme had been aboard the USS George H. W. Bush. Dubois' next weeks are spent making "abduction runs" and conveying "victims" to training camps where they will spend their final days on Earth playing elaborate video games about orbital mechanics. Dubois' few days of personal time involve visiting one of his kids, and grabbing them for a camping trip. His youngest son Henry now had taken up residence at Moses Lake. Hadley, the girl in the middle, was in Berkeley doing volunteer work for an Oakland organization. Hesper, Dubois' oldest, lives outside of D.C. with her Pentagon-stationed military man. Amelia surprises Dubois by flying to D.C., and suggesting a drive into the mountains with him, Hesper, and Enrique to enjoy the fall foliage. Enrique asks Dubois what he's going to be building on the Cloud Ark and for once he can answer honestly, and without cynicism.

Analysis

The themes of survival and exploration remain the focus in Chapters 4-6, as the crews on the ISS continue to expand the structure for habitation. Meanwhile, on Earth, the theme of apocalypse emerges as humanity counts down its final days. As individuals across the globe prepare to perish, sex has taken predominance as a favorite means of recreation. Symbolism supporting these themes include the construction of the Cloud Ark swarm, which relates to the theme of exploration, the establishment of the Luks, which symbolize survival, and the spread of the moon fragments, which represent the impending apocalypse.

This section of the narrative also progresses in the development of plot and character. Dinah's sexual relationship with new arrival Rhys Aitken has more than physical benefits, as he supplies ice for testing of her ice Nats. The character Sean Probst, space entrepreneur with Arjuna Expeditions, plans to capture an icy comet core and



deliver it to the Cloud Ark project, but very few are privy to this information. People like Sean exist in the real world, and author Stephenson brings him into sharp focus as a more-than-meets-the-eye type initially perceived in the story as a selfish opportunist.

A global collective on Earth is manufacturing parts around the clock, and send up a team of Scouts: hardcore workers who will labor outside retrofitting the ISS with trusses and new modules. The Scouts are apt symbols of individual desires to help the project; to escape, at any cost—and Scouts are killed in accidents, some of them occurring in launch vehicles. This portion displays the possibility that humankind is capable of uniting for a common cause but, lacking one, might not ever find such motivation. The author shows this unmitigated survival impulse through characterization and action, rather than (as in some speculative fiction) employing "talking heads" engaged in lengthy dialogues. For such an extended narrative, dialogue is Seveneves' lightest element.

Sean Probst's unscheduled arrival at the Ark in a "Drop Top" is chaotic, and Tekla assaults him. He apologizes for the inconvenience, yet is brave enough to "call bullshit" on the entire Cloud Ark Swarm project—it can't possibly work, he says. No one has even mentioned where the vast amount of propellant required will come from, as Earth will be dead. Here, Sean is already foreshadowed as the (tragic) hero he eventually becomes. As a billionaire, Probst is—ironically—free from moral judgment because his actions are not based on monetary gain; this is another example of the author's subtle warning against making superficial assessments of others.

The Grigg–Skjellerup comet that Probst intends to retrieve, referred to in the novel as "Greg's Skeleton," actually exists. This periodic comet was visited by the Giotto probe in July 1992 when it passed in proximity to Earth. This is just one example of the author's attempts to maintain scientific veracity in the work. Other examples include the author's almost tedious attention to detail in regard to the structuring of the Cloud Swarm project and its architecture.

On Earth, Dr. Dubois and his son Henry's drive to Moses Lake, now a spaceport launching supplies up to the Ark, symbolizes hope. The blazing bolides described as streaking down and booming into the ground behind the mountains are visible symbols of the impending apocalypse. In a scene unlike anything that might happen in real-life, a large group of motorists join together and get the truck back on its wheels. This again shows the collective will at work, and seems to bode well for the future. At Moses Lake a literal campground has grown around the launch facility, and some occupants behave as attending some apocalyptic Woodstock, while others are sober and sad. The author employs subtext as Dubois and Henry don't discuss what's really on their minds (something the reader can easily determine).

The name "New Baikonur," which Dubois dubs the facility at Moses Lake, is a reference to the Baikonur Cosmodrome, the world's first and largest operational space launch facility in Kazakhstan. The nomads who occupy the facility at Moses Lake are referred to as "Space Okies," indicating that they, like the Okies who migrated west during the



Dust Bowl, are desperate to hold onto some hope for a future. Indeed, even the name “Moses Lake” is an allusion, once again, to the Bible.

On the Ark, the arrival of social worker (“first shrink in space”) Luisa Soter piques curiosity, and Dinah finds her watching Dubois explaining something scientific on YouTube, because she knows nothing about technical matters. The conceit here is that not even looming doomsday can stop us from our ingrained social media habits, but author Stephenson here shows both sides of the matter. The Internet can teach us things we need to know.

Sean Probst's Ymir mission to capture comet “Greg's Skeleton” becomes a reality, but no one's supposed to know about it. Dinah certainly does, as she does robotics work for Sean's company. On Earth, Russian authorities demand that Sean and his people be placed under arrest for violating ISS protocol, but it's too late to stop them. Sean proves the old maxim that only an honest man can live outside the law, and the reader has to wonder whether Probst represents private enterprise (from whom government and military technologies often benefit) shoving stodgy regulated types out of the way for authentic progress. If so, he succeeds.

Probst has named his mission to capture Greg's Skeleton the “Ymir mission.” This is a reference to Norse mythology, wherein Ymir is the ancestor of all jötunn, or mythical ice giants. In the Norse creation myth, the Earth was fashioned from Ymir's flesh, the oceans from his blood, the hills from his bones, and from his skull the heavens came into being. It is therefore a fitting metaphor that Probst's mission be named after this god, as the capture of Greg's Skeleton will indeed ensure the future of human life and foreshadows humanity's eventual return to Earth.

It is determined that the Ark structure, once completed, will not be sufficient to sustain human lives for 5,000 years, something with which the reader might agree. The idea is presented to mine metal from asteroid Amalthea, which has been bolted to the ISS since well before the Agent struck the moon, and is where Dinah tests her prototype robots. The Cloud Ark population must learn to smelt metal for construction purposes if they expect to survive. This notion sounds impossible, but the author shows how it can be done, and all with more or less available tools and programming of robots. It is easy to forget that 75% of Seveneves is set in our time. By Day 220 CAD engineers are complaining their software can't keep up with the progress on the Cloud Ark construction, and Dinah deploys robots with cameras to gather imagery and send it to Houston and elsewhere. There are now eight spaceports around the globe launching supplies and people to the Ark project, and it's difficult to imagine a more enduring symbol of international cooperation, given that most of those on Earth now know they will die in less than two years.

Both internal and external conflict emerges when President Flaherty orders Dr. Dubois to join the Ark crew and he refuses. She reminds him this is equal to being released from a death sentence, and the reader can empathize with his anguish: he has a wife, Amelia, and children. Worse, the President and Peter Starling—science adviser—expect him to lie to the public about the Cloud Ark. He'll be nothing more than a



cheerleader to keep people happy and "informed." The author presents foreshadowing on the Ark when Commander Ivy Xiao suspects her once-future husband, Cal Blankenship has a contingency plan to survive the destruction of Earth's surface. Dinah MacQuarie suspects her father has similar ambitions for himself and his fellow miners in Alaska. It must be imaginable that in a real-world scenario some would attempt to survive what appears inevitable to most, and this foreshadows later discovery.

Locked into orders, on Earth Dubois spies the silvery star of the Cloud Ark passing overhead, and despairs over his family's future. He lacks even the possibility of wondering how they'll survive without him—they won't, along with six billion others. There are three months remaining before he must leave for orbit, and he vows to spend them his wife, Amelia, and family. Abruptly he is sent to Bhutan to cover a Casting of Lots ceremony, during which a boy and girl will be "abducted" (as the journalists say) and sent up to join the Ark. On the way, a photographer named Mario tells Dubois that he will be given "sacred" objects that the locals expect him to preserve on the Ark, but as soon as the helicopter returns to the aircraft carrier with the children—Dorji and Jigme—these will be thrown into the sea. There's no room on the Ark. Again, this is another example of what might be viewed as incredibly cynical storytelling but, in reality, almost certainly would be a simple practicality. Space flight is terribly expensive and inefficient, and every gram of weight taxes this system.

The author makes another mythological allusion when Dubois recalls the Greek myth of Theseus and the minotaur, wherein the people of Athens had somehow been persuaded to select seven maidens and seven boys by lot, every few years, and send them to Crete as minotaur food. Who, Dubois wonders, actually would do such a thing? But he knows who: the populace of Bhutan; Seattle; the Canelones district of southern Uruguay; the Grand Duchy of Luxembourg and the South Island of New Zealand. Places Dubois would visit over the next two weeks to gather maidens and boys chosen (mostly) by lot.

In orbit, Ivy, Dinah, and several others test the first "bolo"—two arkllets connected by a long cable in order to spin around a common center to generate simulated gravity. This succeeds, if only in a technical sense. This connection represents progress and hope for the project, but on a deeper level it is also reflective of reproduction, upon which humanity's preservation is dependent. On camera, Dinah breaks down crying when she realizes the empty arklet is the first time in a year she's been in a space not crammed with other people.

Dubois' newfound obsession with camping is a dramatic attempt to hold onto the Earth, to which he will soon say farewell. He and his family enjoy warm indoor spaces with food baking and frying in a clean kitchen. Speaking with Dubois about this pastime, Tavistock Prowse asserts that, in 1,000 years people will go on "camping trips" in arkllets, drink Tang, and pee into tubes just like their ancestors did. To them, Dubois says, that will be a back-to-nature experience. This imagery from the author indicates just how different the new world will be. The meteor that streaks across the sky while Dubois camps with his family foretells the most certain, and quickly approaching, demise of the Earth.



Discussion Question 1

The character of space entrepreneur Sean Probst more than likely is inspired by actual people, some of whom have had great success. Discuss the benefits and hazards of private space exploration.

Discussion Question 2

The International Space Station (ISS/"Izzy") is a real-world place. In *Seveneves*, world leaders and scientists choose to expand its infrastructure to capacitate at least 1,500 people rather than construct a new vessel. This results in many problems and hardships. Discuss alternatives.

Discussion Question 3

The "bolo" experiment to produce simulated gravity is a dramatic scene. Discuss the importance of gravity to the human body, and why zero-gee is a limiting factor to long-term survival in space.

Vocabulary

iridescent, cantilevered, opaque, complement, ostensibly, aggregation, nadir, coefficient, adjunct, latticework, scuttlebutt, emblazoned, stopgap, deadpan, palatial, chimera, prostrate, metempsychosis, quantum, bolo, taikonaut



Section 3, Chapters 7—9

Summary

Chapter 7 begins with Doc Dubois floating in the heart of Arklet 2, docked now at Izzy. Dubois wears a pressure suit with a helmet slung under his arm. He likes this new do-it-yourself aspect, but wishes Amelia were there; imagines instead he's addressing students in her classroom in Pasadena. The video will be an educational primer on arklet swarms, and Dubois also explains that any video-gamer can learn to pilot an arklet. Dubois has been in orbit for six days—one year to the day since he witnessed from the Athenaeum the moon's fragmentation.

Back inside Izzy, Dubois literally "runs" into Dr. Moira Crewe, whom he'd last seen at the Crater Lake announcement where she had been assisting her mentor, Clarence Crouch, the Nobel Prize-winning geneticist. They drift into Moira's lab, where Moira details how genetic manipulation can create heterozygosity (diversity) artificially and even eliminate defects. Moira goes on to explain that if something like the infamous Irish potato famine were to affect precious algae upon which people will rely to produce breathable air, it could spell the end. Since bringing actual biological samples into space was impractical and likely to fail, Moira explains that a clunky version of gene synthesis technology is being used to encode animal and plant DNA into digital form for electronic storage.

On Day 700 (A+1.335), the Cloud Ark viewed from Earth resembles a bright bead strung on a silver chain. As Doc Dubois had tried explaining in his DIY video shot on Arklet 2, it was ruinously expensive, in terms of propellant, to maintain an actual cloud or swarm of arklets around Izzy. A cheaper, more reliable method would be to have the arklet swarm precede or follow the space station along the same orbit, similar to a line of ducklings with "Mom" in the middle. On Day 700, the general population stands at 1,276. New arrivals are assigned to vacant arklets waiting at the head or tail of the queue. The looming menace of White Sky is a tremendous problem. This will put many more rocks into their path, some of them very large. Fortunately, these can be detected and avoided, but much smaller debris could still be deadly.

Dinah MacQuarie and Arjuna Expeditions make progress "embiggening" the asteroid, carving out slabs of metal, elevating them like flaps on an airplane wing to extend the sheltered envelope, but it could only get so big. Latticed now in scaffolding anchored by Dinah's robots, the asteroid sports a bristly projection of radar and communication antennas. With roughly three weeks before White Sky, Arkies are expected to live in zero-gee and save the bolos for the very long-range mission. Working out in the special zero-gee gym, Dubois meets social worker Luisa Soter, who asks if he even bothered to visit Venezuela during his Arkie-collecting duties. By her tone, he suspects something is afoot.



Regarding that general region, Dubois had heard some recent chatter about Kourou, in French Guiana where the Europeans, and sometimes the Russians, launched big rockets into orbit. Luisa says the Venezuelans are very angry that out of the 75 people chosen by Casting of Lots, three or four ought to have ended up on the Cloud Ark—but that hasn't happened. Worse, Luisa informs him that Venezuelan squatters have taken up protesting on Devil's Island, a former prison directly under the path of rocket launches. Darker still, on her tablet is an image of battleships blocking the waters by the European Space Agency.

Ivy enters the gym; she had been replaced eight months before by Markus Leuker—Swiss fighter pilot, mountain climber, and astronaut. To accommodate the Cloud Ark fleet and Izzy's hugely expanded complex, the powers-that-be decided a new leadership structure was required. The commander would soon become the most powerful leader in human history, and all humankind would be under his or her authority.

Oddly, even with one person as commander, the Cloud Ark has no central control room but simply a confusing variety of thrusters controlled through a web interface accessible on any tablet by someone with the correct password. Hence, the command center could be anywhere. Arkies call the room where Markus works the Tank. Doc Dubois discovers this area usually is the least crowded section on Izzy and has gravity good for bones, coffee, and toilets. He visits several times a day, has a beverage, and checks for news updates.

Around Dot 2, Dubois arrives and scans the wall's projection screens. A large one at the Farm's end gives a night-time view of some area on Earth. A label superimposed at the bottom identifies the imagery as KOUROU, FRENCH GUIANA. White points tell Dubois he's looking at thousands of boats that have joined the "People's Justice Blockade," beyond which can be seen the spaceport where waiting rockets cannot launch while still under the threat of Stinger missiles. Another screen shows the White House Briefing Room, gearing up for a presidential update. The People's Justice Blockade is an operation hatched by the Venezuelan government, slowing the building of the Cloud Ark. Worse, the Venezuelan president declares White Sky a hoax. Armed protesters have invaded French Guiana's beaches and are being engaged by the French Foreign Legion, U.S. and Russian Marines. Houston calls Dubois and demands he record a response, which he does, saying how everyone must work together. Earthbound conspiracy theorists believe the Ark is a hoax, and Houston tells Dubois to re-record his message while floating in zero-gee.

Dinah overhears Dubois and Markus, and is glad to be left alone. A Morse code message beeps, and she suspects it's from the Space Troll—a poorly skilled Morse user trying to contact Dinah. Dubois returns, and he thinks the Space Troll is someone simply messing with her mind. But when Dinah switches over to another special PC board, and still receives the message, she tells Dubois that she thinks it's Sean Probst calling from the near-forgotten Ymir mission.

Dubois questions the validity of this suspicion, and Dinah quickly verifies that the MAC address matches that on one of Dinah's robots on the Ymir. Dubois helps decode the



message: TWO ALIVE. THRUSTING AT FULL POWER. SEND SITREP. Assuming Sean plans a return to Earth orbit, Ymir will arrive in 37 days; roughly 17 into Hard Rain. The two hope he plans to stay in a higher orbit above the incoming debris, where he can be met by a rescue ship. Dinah must wait until Izzy comes out of the dark zone behind Earth before responding.

Dubois exits for sleep and Ivy abruptly appears and asks to look out Dinah's window. The area around the Kourou spaceport is flaring with explosions as if under attack. Then, an intense light like the sun blossoms into a fiery mushroom over the sea. Nearly in tears, ex-commander Ivy tells Dinah that Ivy's once-future husband, Cal Blankenship, must have been ordered by President Julia Bliss Flaherty to nuke the Venezuelan Navy, in order to resume rocket launches carrying Ark supplies.

Dr. Moira Crewe watches clipped-together cell-phone video covering the recent "war" and nuke strike near the Kourou spaceport. The scarred Russian, Tekla, is there and asks Moira's opinion of the attacks. Markus—the new Izzy commander—enters, and claims to have been ignorant of President Flaherty's decision to order a nuclear strike. Luisa chimes in, noting the Ark has no laws, rights, constitution, legal system, or police. Markus says it's being worked on by a think-tank of constitutional scholars in The Hague, one of them now living on Izzy.

Moira laments not having had sex in a long time, and wonders what the policy here is toward pregnancy. Will embryos be removed, and frozen, to be implanted much later when ever-present doom is no longer a serious threat? Moira darkly suspects that geneticist Dr. Andrada, who delivered and installed frozen sperm and eggs from Earth, does not actually believe any samples will survive. After a Sambo martial-arts match with Tekla, Markus says he doesn't like having found 12 Tasers on the Cloud Ark. With a population of 2,000, though, there will be crimes and disputes. Arker Bolor-Erdene asks what the new Constitution says about police, and Markus sarcastically admits to not having read the two-inch thick by-committee document. Markus suggests his small posse, future police, learn to wrestle.

Day 720, two weeks hence, is predicted for the manifestation of White Sky. Dr. Dubois has a bad video talk with Amelia and the children, who are preparing to die. Governments are issuing free euthanasia pills, and mass graves are a daily reality. In truth, Dubois wishes they were already dead, so he can get on with the "big adventure" before him. He admits this to social-worker Luisa, who tells him not to feel shame and guilt, as this attitude is normal among those caring for terminally-ill people. Long-silent Dinah meets with Dubois, and informs him of a terrifying message from Sean Probst's Ymir mission.

Markus meets with the Only Lawyer in Space, Salvatore Guodian, asking the nature of his own authority. Guodian tells Markus that under PSAPS (Periods of Simplified Administrative Procedures and Structures—akin to martial law) he is authorized to deputize specific people to enforce his decisions "using appropriate levels of physical coercion." Dr. Dubois informs Markus that "Eight Ball's" passage through the debris cloud will likely escalate White Sky—in five hours. Only Moira—who will have to



redistribute the frozen DNA to various arklets to ensure preservation—will be told. It is also agreed to begin the Surge, last-minute launches from Earth of vital supplies, planned long ago for the period between White Sky and Hard Rain. Markus calls in to his tank Steve Lake, a long-haired hacker type from Virginia, and tells him to change all of Izzy's control systems' passwords, and to leave out of the loop Steve's boss, Spencer Grindstaff, an NSA network and communications specialist who'd been on the station since the early days. Markus doesn't trust Grindstaff.

Chapter 8 opens during the last hours of Day A+1.335, with the cloud of lunar debris present in the sky over the last seven hundred days slowly expanding like a time-lapse explosion. The Bolide Fragmentation rate spikes, but Dr. Dubois ignores it, his obsessive calculations now obsolete. Dubois is coldly interrupted by Markus, who demands his presence. Bluntly, he tells Dubois, "Your family is dead..."

Chapter 9 begins with the fall of Hard Rain, and the destruction of Earth's surface. Rufus MacQuarie's friends, family, and associates establish a defensive perimeter around their holdout in Alaska's Brooks Range. Rufus uses his antique telegraph key to contact his daughter, Dinah, on Izzy. Ivy Xiao listens to a broadcast organized on Day 701 by a collective of cultural organizations begun around the original Crater Lake announcement. Through NASA's patch to military communications, Ivy is able to contact her once-future husband Cal Blankenship, who releases her from their vows.

A Streaker Alert sounds, meaning an incoming bolide has been detected by the Sensor Integration team. Izzy must fire correcting thrusters or risk taking a potentially deadly hit. Ivy's phone buzzes, and Cal—from the nuclear submarine—sends anguished words. Cal's last texts (one saying the U.S. President has gone dark, and a 100-foot wall of water has crushed Manhattan) tear through Ivy, and a final image taken through the submarine's open conning-tower hatch. The blazing red sky viewed through the wedding ring Cal has pinched between thumb and index finger.

Doc Dubois joins Ivy and tells her his family connection simply faded away. Commander Markus Leuker's voice sounds from the all-Ark PA system: The Cloud Ark Constitution is now in effect. All are now citizens of a new nation, the only nation. Dinah knows that 500 people will now weld themselves into the Alaskan holdout, with enough food for 50 years, when the MacQuarie descendants ought to be self-sustaining. She has no idea if the plan can succeed. Markus, over the PA, calls for 704 seconds of silence: one for each day since Zero.

Dinah is shocked to be summoned, by Ivy, for duty only five minutes in to the silence. Parambulator has lit up roughly 100 arklets, warning them out of the way from an incoming craft someone identified through an optical telescope: a Boeing X-37 Orbital Test Vehicle. Dinah and Ivy (assisted with the hatch by the lone Tekla) must meet the X-37 in a Flivver, or Flexible Light Intracloud Vehicle. Pressurizing the now connected ports, the women see a mysterious item taped to the aluminum hatch: a common sheet of 8½ x 11-inch printer paper adorned with a color emblem of the United States President.



The open hatch reveals a green, bloated, haggard Julia Bliss Flaherty—former President. At the cylinder's one end floats science adviser Pete Starling, nearly expired after swallowing a euthanasia pill in the limo. A jarring popping sound is heard, and Starling's torso spurts blood over Dinah. Safely inside the Flivver, Dinah encounters the strapped-in dry-heaving Julia. Enraged, Ivy reads her a virtual riot-act, stating Julia's fleeing Earth was not only illegal but a huge danger to the Cloud Ark. Julia says she's sorry, but is cut off by Ivy's promise to "stave your fucking head in." Horrified, Dinah recognizes the Moira Crewe-curated Human Genetic Archive, and dares ask Ivy whether Moira completed the dispersal project of spreading DNA samples throughout the Swarm to ensure preservation. Ivy doesn't know.

Analysis

Chapters 7-9 explore the themes of apocalypse, survival, media's control of the masses, reproduction (and preservation), and collectivism. Doctor Dubois' presence on the ISS reflects the theme of the media's control of the masses. Dubois acts as a sort of science consultant/educator in his "spare" time when not addressing the TV/Internet audience on the ground.

Dubois' compartmentalization of emotions attached to Amelia and the children are breaking down, and this stands out as he does a solo video recording of a primer on how easy it is to learn arklet-piloting. If you can play video games, it is claimed, you can become a pilot. This is similar to real-world media accounts about the relative ease of learning to fly armed drones. What Dubois doesn't say is that for every 100 people in a training camp, perhaps one or two will actually make it into orbit. Like so much about the early build-up, this anti-transparency (termed "disinformation" by government intelligence agencies) exists to prevent panic and rioting, yet results in public anger and distrust of authority.

Dubois wishes he were in Pasadena with Amelia, interacting with her classroom kids. He literally runs into geneticist Moira Crewe, who is charged with the tremendous responsibility of preserving the Human Genetic Archive. The Human Genetics Archive symbolizes the only hope for human preservation and supports the theme of reproduction in this section of the novel. The author's frank portrayal of both Dubois' and Moira's emotional turmoil (both are suppressing rage and despair) brings chilling texture and realism to what appears to be a hopeless situation.

Moira hasn't seen Dubois since the Crater Lake announcement, and hugs him, admitting to be happy—PCA—to see him (Present Circumstances Aside has become a staple on Facebook, Twitter, etc., and used by millions). Dubois is angered, but keeps it to himself, when Moira innocently states he is a cheerleader for the Ark. This resonates with real-world "celebrity" scientists and experts, some of whom are parrots for corporate, military, and/or political concerns.

Utilizing robots and human workers, Ivy and Dinah "embiggen" asteroid Amalthea, raising from its bolted-on mass great flaps to act as shields against lunar debris.



Heptads—clusters of seven arklets—are fixed to the Ark fore and aft and used as housing and thrusters. Nothing in space has only a single function, and the author is adept at showing how space workers live in a leaky cramped environment full of foul odors, popping and pinging hulls, solar radiation, and the ever-present threat of micrometeoroid strikes. This highlights how (at least in space) most problems have mechanical solutions, except those created by human strife. These efforts also support the themes of both exploration and survival, as the crew must constantly face new obstacles in creating a sustainable, habitable environment.

Work has been divided into three shifts similar to Earth factories, so one-third of the GPop (General Population) is always awake. Dubois is a third-shifter in order to be "in" the same time-zone as his West Coast wife and children. Dubois' behavior in this section might be viewed as dissociative (in the emotional sense), but perhaps anyone in his situation would be thus afflicted. He maintains functionality, and hides well his growing dread.

When Venezuelan protesters occupy ships with Stinger missiles, the European Space Agency launch facility is blocked. The Venezuelans have discovered that Casting of Lots somehow is not resulting in their people being selected to go into orbit, and they promise to destroy any rocket launched, which halts vital supplies reaching the Ark project. This conflict, as well as later ones that develop among the survivors, reflects a Cold War-like situation. President Julia Flaherty orders a limited nuclear strike, which destroys the "pirate" fleet. This is a shocking moment in the book, but the reader must wonder if present authority really would have any other choice, given the extreme time limitation on Earth's life-span. This is comparable to the decision made in World War II to use atomic bombs against Japan, done with very little pondering over ethics.

The replacement of Commander Ivy Xiao by Markus Leuker reflects the theme of collectivism. This theme, in the sociopolitical sense, doesn't intensify until after Hard Rain, when the Earth's surface is both pummeled and super-heated by falling lunar debris. However, the theme begins to develop here, with Markus' appointment. Ivy suspects her replacement might have had something to do with her hand in rescuing the Russian woman, Tekla, from certain death in the airlock. Anguishing over never being able to see Cal again, she doesn't really care, and wonders if it was he who fired the nuke at the Venezuelans.

In the replacing of Ivy with a male, the author somehow makes the gender-equality issue redundant. Ivy isn't replaced because she's a woman, but because the "brass" disapproved her singling out one expendable human and wasting precious resources to save her. Once again, brutally hard decisions are made with no time for doubt or second-guessing. This aspect of the narrative makes the 880+ pages go by at some pace, which doesn't relent until the book's final section.

Dubois has a harsh video call with his family, who are preparing to die. Governments are offering free euthanasia pills, and rumors of mass graves circulate. Dubois tells himself he wishes they already were dead, and so regrets the thought he seeks Luisa Soter's psychological counsel. She tells him such feelings are normal; the same



expressed by those caring for a terminally ill loved one. A covert message comes to Dinah from Sean Probst's Ymir mission: an asteroid called Eight Ball is headed directly toward the lunar debris cloud and Ark, and will likely escalate the Hard Rain—Earth's end.

Commander Markus Leuker is aware of incoming secret messages, and fears some sleeper agent on the Ark might stage a coup d'état. The reader wonders if paranoia will end Markus, especially after he orders hacker Steve Lake to change all command passwords (favoring Lake over former NSA wizard Spencer Grindstaff, and foreshadowing dark events involving surveillance).

On Day A+1.335, Eight Ball plows through the debris and escalates Hard Rain. Earth has even less time remaining than before—perhaps as few as five or six hours. Dubois weeds out 90% of the names on his goodbye list, and increasing bandwidth traffic puts hours-long gaps between his texts to Amelia and family. Finally Henry, one of Dubois' sons, gets through and says the atmosphere is getting very hot from constant bolide falls. In the Woo-Woo Pod (nondenominational "chapel") Dubois gazes down at the fire storm, and tells Henry a large bolide is heading for British Columbia. Markus interrupts by calling Dubois to duty and saying, "Your family is dead..." Markus' machine-like behavior, the reader learns, is driven by something other than paranoia and sociopathy. It only appears as such.

The author employs imagery (simile, metaphor, etc.) in his descriptions of the arrival of Hard Rain (trillions of blazing bolides, or meteorites), which destroys Earth's surface and everyone on it. The symbolism and imagery here is again reflective of Biblical descriptions of the apocalypse. Glaciers and oceans boil. Amidst this, Rufus MacQuarie prepares to enter the massive holdout constructed by him and his crew of 500 in an existing mine. Using the antique telegraph (all other methods are now gone), he contacts daughter Dinah on the Ark and tells her it's hot enough to bake potatoes on his truck's hood. Here again, the reader can see that Rufus' level-headedness and acuity in employing Morse Code have proven effective.

Dinah imagines someone throwing a fire blanket over Rufus and forcing him into the holdout, where the blast-door will be welded shut. Rufus manages to keep his rugged sense of humor, and love for Dinah, intact. Weeping Dinah does the same. Ivy tunes in Radio France, and listens to a live orchestra all the way to its awful ending in rumbles, shattering glass, and static. This moment creates an eerie and solemn atmosphere for the reader. Via NASA's patch to military channels, Ivy contacts Cal, and they tearfully release one another from their wedding vows. The author employs symbolism and imagery again when Cal captures the burning sky as seen through his engagement ring held up to the submarine's open hatch.

Dinah moves to the Woo-Woo pod, crammed with screaming people, and meets Dubois. He wasn't able to say a final goodbye to his family because the connection faded away. Markus declares 704 seconds (one for each day since the Agent fragmented the moon) of silence, but in the middle of this Ivy is summoned to duty by



Dinah. The author renders these scenes with a mix of lacerating emotion and stark brevity. Despite the cataclysmic horror of Earth's destruction, the crew must function.

Cloud Ark commander Markus Leuker declares the equivalent of martial law, and the former International Space Station becomes a technical oligarchy. Meanwhile, Ivy and Dinah respond to an incoming illegal space-craft, an experimental X-37 similar to the obsolete Space Shuttle, whose very presence threatens the entire Ark, because precious resources must be squandered by hundreds of arklets firing thrusters to avoid collision and possible destruction of the main vessel. Docking with the craft, the two open the airlock and see taped to the X-37's hatch a page of printer paper emblazoned with the Presidential Seal.

Julia Bliss Flaherty is inside the X-37 with her dying science adviser Peter Starling, who has swallowed a euthanasia pill. The former President is haggard and insane-looking. A micrometeoroid punches through the hull and Starling's torso, instantly killing him and splattering Dinah with blood. As the ship hisses out its oxygen, Julia (who will survive to be one of the Seven Eves) dashes out and into the rescue ship—closing the hatch on Dinah. Here the author begins a maddeningly complicated dynamic between Julia, Ivy, and Dinah who, at this point, want to kill her for endangering the entire project.

Dinah makes it safely into the ship, and the X-37 is pulled out into empty space where it will eventually re-enter and burn up with everything else on the planet. Dinah and Ivy can see a section of the Ark has been torn open by debris. Unfortunately, this module held the Human Genetic Archive, and they wonder whether Moira Crewe completed distribution of the HGA among various arklets, which plan was in place to decentralize the stock to protect it from catastrophic incidents like this. This example of foreshadowing indicates the importance, later on, of the Seven Eves and their role in repopulating the Earth.

Discussion Question 1

The Casting of Lots—random selection—devised in *Seveneves* for nations to contribute young men and women to the Cloud Ark causes many problems, political and otherwise. Given a real-world situation threatening the world's end, with only so many people able to be spared, what other selection methods might be employed?

Discussion Question 2

The rogue asteroid Eight Ball passes through the lunar debris and escalates Hard Rain and the destruction of Earth's surface. The character Sean Probst detected it long before it became a threat, but still nothing could be done. Real-world astronomers are tasked with watching for potential dangers like this, but not much budget has been allotted to actual contingency plans. Given the very low chances of a direct hit, do you think there should be a more active program devoted to this?



Discussion Question 3

Soon before Hard Rain strikes, there are mass suicides sanctioned by governments who provide free euthanasia pills. It has been claimed that science removed mystery and faith from the universe, creating in humanity a spiritual vacuum yet to be replaced. Almost all schools of philosophy address this notion. Do you think a "new" existence-based religion will evolve? If not, will anything useful fill the apparent void, or is intellect sufficient?

Vocabulary

pundit, aft, consternation, interface, sanctum, lectern, crypto, tuft, austere, monochromatic, fractal, aesthetic, spectral, pellucid, elliptical, bolide, propagate, polyphony, snide, continuum, fratricide

Section 4, Chapters 10—12

Summary

Chapter 10 opens in Commander Markus Leuker's think-tank, where he, Dinah, Ivy, Moira, Salvatore Guodian, and applied mathematician Zhong Hu reluctantly indulge former U.S. President Julia Bliss Flaherty's recounting of her trials on Earth, and the illegal escape that brought her here and endangered the entire Cloud Ark Swarm. Julia is curtly asked to leave, and does. Moira is questioned about the Human Genetic Archive, and stumbles. Markus texts Doc Dubois to join them.

Dubois disagrees with Markus' writing off the HGA, but understands that the Ark population, as is, is sufficient to ensure heterozygosity. Moira says she has the equipment to turn digitally coded DNA into implantable embryos—but it must wait until a permanent habitat is established, which depends on Sean Probst delivering the icy comet core. Finally, Markus reveals Sean Probst's death and states that someone will have to journey out, land on the comet, get inside ghost-ship Ymir, restart the nuclear reactor and perform the final burns to bring her into sync with Izzy.

Markus declares he is placing Ivy in command of Izzy and the Cloud Ark, and will gather a crew to venture out in a Modular Improvised Vehicle. They will board Ymir, manually perform control procedures to get her payload to Izzy, and use what remains of the comet ice for propellant to raise the Ark's orbit for the Big Ride. Ultimately, the Big Ride will take two years, during which vital resources will be moved inside Amalthea—including Moira's humankind-saving genetics lab. Dinah will be accompanying Markus out to Ymir.

Dubois asks to help, and is both crestfallen and relieved when Markus tasks him with figuring out how the mission will work, as well as calculating the actual course for Cleft. A new, small craft is assembled. The New Caird is crewed by Markus, Dinah, former Soyuz cosmonaut Vyacheslav Dubsky, and nuclear engineer Jiro Suzuki, designer of Ymir's drive. If the Ymir hook-up fails, New Caird has no way back to Izzy, having expelled most of its propellant in a series of high-gravity burns. Nearing Ymir, the comet can be seen covered in black dust, determined to be yet another tip-of-the-hat from Sean: a layer of micronutrients for Izzy's gardens scraped from the parent core.

The Ymir's docking port must be reached through three feet of ice, and inside Jiro finds a log of endless error messages and Sean's final commands to the robots, still working. Sean himself is found floating in a blood-soaked sleeping bag zip-tied to a strut. In the ice tunnel leading to the pressurized reactor chamber, Jiro discovers the body of Larz Hoedemaeker, Dinah's long-ago assistant. Back inside Ymir's lower chamber, Jiro panics when he finds high beta radiation, and must stuff items into a duct tape-wrapped garbage bag for airlock ejection. If New Caird succeeds, then the Big Ride to Cleft might be possible; the hundreds of arklets could assume higher and safer altitudes behind the shelter of Amalthea's metal and Ymir's ice.



Former U.S. President Julia Bliss Flaherty, recovered from her harrowing launch/rescue and trained in space survival, resides in Arklet 174, where she is nearly overwhelmed by a reunion with 18-year-old Camila. Victim of a shotgun wound to the jaw, Camila had been fundraising for the education of Afghanistan's and Pakistan's girls, and was then worked on by world-class plastic surgeons later interrupted by Camila's selection as candidate for the Cloud Ark. Still considered Madam President by many, Julia has followers in the small heptad of 29 Arkers, one of whom is former NSA network wizard Spencer Grindstaff. Julia is building a private agenda, and suspects a conspiracy in Izzy's policy of allowing only seven arklet "gangings." Former U.S. astronaut Zeke Petersen visits Arklet 174 and is drilled by Julia regarding closed meetings on Izzy to decide which arklets will be moved closest to Amalthea for better protection against lunar debris. She doesn't like General Population (GPop) making all decisions and leaving out the Arkers.

Izzy's general population has become the equivalent of dead Earth's "old school," i.e., tending toward face-to-face socializing and articulate language use. The more isolated Arkers are younger, embrace social media, and are suspicious of Izzy's "GPop." Julia has become their rep, and argues for a mission through "Clean Space" to Mars, which Dubois says has been studied and deemed impossibly hard and dangerous, plus would take too many resources from the Cloud Ark.

Jiro, on Ymir, is charged with controlling the unstable reactor that will—or won't—slow the mission enough to survive, and join with the Cloud Ark. The burn succeeds, and over her headset Dinah hears celebration on Izzy. Dubois is cheerful, and declares the safe arrival of Ymir and Greg's Skeleton will change the political picture. The Martians—Dr. Katherine Quine, Ravi Kumar, and Li Jianyu—attend a meeting assembled by Julia. Arklet 453, safe from surveillance, has become the central common-space arklet of the heptad.

Julia and her "Martians" discuss the Mars venture, and she is informed that it will require 10 stacked arklets that later can be boloed for simulated gravity, as the trip takes six months. At the same time, on Izzy, another meeting is active between Ivy, Dubois, Luisa, Fyodor, and three handpicked members of Markus' staff. There is concern over no one being able to track who is residing in—and visiting—Julia's heptad. Zeke Petersen is summoned, and says the atmosphere over there is crazy, with Julia manipulating and recruiting Arkers. Meanwhile, Julia tells her followers that Parambulator is a control tool under the guise of "public safety."

Ivy decides Julia is no serious threat, but nonetheless ought not be ignored, so assigns Tekla (as Markus' security head) to make an official visit and openly state that the arklets' "problems" with Situational Awareness Network could result in very serious outcomes. When Ivy remarks that Julia might try and recruit Tekla (a very good catch), the tough Russian suggests becoming a "mole" in Julia's camp. There are recent problems with New Caird/Ymir: the Sean-installed thruster nozzles on the comet are not enough to swing around the massive ice chunk, so Markus has stuck Dinah and Jiro in Ymir's command module, Vyacheslav outside near the structure over the docking port, and himself at New Caird's controls. Several attempts fail; the last kills Markus and



ejects the entire craft into space forever. Julia and Spencer congratulate themselves after Tekla's visit, during which they fooled her into believing they "bought" her turn-coating on Ivy and Markus. On Greg's Skeleton, Vyacheslav is low on oxygen and must come into Ymir with Dinah and Jiro—but his suit is radiation-contaminated. Dinah and Jiro seal off a room, enabling the Russian to enter via adjacent airlock, undress, clean himself, and dispose of all irradiated material by way of the docking port. But beta-radiation already has entered his system.

"Streaker Alerts"—warnings of incoming lunar debris requiring movement of arklets and Izzy—come in several times per day, and some Arkers claim these are yet another control tool. A meeting in the Banana between Dubois, Ivy, Luisa, Sal, Tekla, and others, is called to discuss Julia and her followers. Ivy will offer a 24-hour period of amnesty during which any person may return stolen items that have been hoarded for the Mars journey. After that, Tekla and her team will move on one arklet known to be used as a storage dump for contraband.

Julia and Spencer use the bug and listen on a laptop, then call together the core members of the Mars mission. Paul's brilliant plan is to use the already under-construction Ymir rescue MIV for the breakaway Mars trip. While Tekla, Sal, and a few others enter a suspected hoarder arklet with the first search warrant in space, a Streaker Alert sounds, and they realize the arklet is a decoy. Ravi advises that the MIV—Red Hope—must depart now, because Tekla's relentless energy could find some way to derail an already stripped-down mission. Julia wishes the crew of 24 well, and they make for departure, with Camila crying out to warn of an actual incoming bolide. In Izzy's Caboose Julia and Camila see four GPop workers have been lashed with zip-ties to struts. As Red Hope prepares to launch, Tekla and her security crew spring down the corridor. Julia raises dead Pete Starling's revolver and makes the mistake of firing it. She is flung back, and can see Camila's arm is wreathed with fire.

Ymir has Izzy in optical view, but is now virtually a crew of one: Dinah. Vyacheslav is presumed dead, sealed in his radiation-hot quarantine. Julia mourns those GPop workers killed in the bolide strike that hit between tori one and three, announces her new presence on another arklet, and wishes for Cloud Arkers to abandon the dangerous station and join her Mars mission. Three Flivvers rush to meet Dinah, and she executes Sean Probst's long-ago JETTISON command to detach Ymir from the nuclear reactor engine. On board Izzy at last, Dinah joins Ivy, Dubois, Moira, Rhys, Luisa, Steve Lake, Fyodor, and Bo in the SCRUM section protected by Amalthea's iron mass. Three hundred died in the Caboose, leaving Izzy's population at 400. Another 800 had gone with Julia—two-thirds of the human race.

Dubois admits he is more concerned that they have enough arklet engines to push them beyond the old moon's orbit. Camila hands over the listening device that Julia and Spencer used to eavesdrop on Izzy, and is asked why anyone should trust her: she might be a left-behind spy. Camila declares she now hates Julia after seeing her insane behavior.



Chapter 11 begins one month later, and Dinah's relentless 'Nats have flowed Ymir and Izzy into an orbiting ice mountain christened Endurance. Eighty-one arklets in nine groups of nine are attached to the aft end, the crippled Caboose having been cut off. Big Ride begins, its goal being that of journeying 378,000 kilometers to humankind's nest: Cleft. The mission is always lacking adequate food supplies, despite the arklets' growing of vegetables in their translucent outer hulls. One year's provisions are cut back, and sickness spreads. Suicide, over three years, takes one in ten. The population skews toward females, as men need more food and air, and are more vulnerable to radiation. The Arkers fare better, having come up in the last months before Earth's death. Communication between the Swarm (Julia's Martians) and Endurance resembles that between two Cold War nations: only when necessary.

Dubois' eyes have changed shape from extended zero-gee life, and he must plug his laptop into the Banana's huge projection screen to work. Out of the 27 left alive, he alone watches blurring digits for the moment marking apogee, when Endurance reaches beyond the distance at which the moon once orbited Earth. In two weeks—if they survive—Cleft will be their final stop. Dubois knows he has cancer. In the "Hammerhead," A young Italian girl, Aïda Ferrari, contacts Dubois to relate that only 11 out of 800 have survived, and Tavistock Prowse apparently is close to death. The girl claims Julia was defeated through a social media campaign, and that starving Tavistock ended up eating his own leg. The others are surviving too by eating the dead.

A meeting is held, with Ivy and Luisa advising the others to get over being creeped-out by Aïda and thoughts of Julia. It is stressed that one-third of the remaining human race cannot be ignored, so Endurance best prepare for them. Any error might result in ending humankind. It is agreed to cable the incoming Swarm's heptad to Endurance's Stack; leave the hatch closed until the rock-battering either destroys them all or they arrive at Cleft.

Much had changed in Amalthea's iron mass since Day 14 when Dinah had her robots hollow a safe space for her electronic parts. Considerable labor had been expended to create storage for Moira Crewe's genetic equipment, basically the reason for the entire mission. At a meeting in the Banana, Dubois has bad news: they are 48 hours from apogee, severing Amalthea, and setting out to land on Cleft. Dubois informs the crew he has detected on the sun a coronal mass ejection that will hit the Endurance and—when it arrives—Red Hope. The 11 in Red Hope will fry if not taken inside the larger ship, and healthy-looking Zeke Petersen (second in command now) reminds everyone that the plan was to cable Red Hope to Endurance's belly and leave the hatch closed. Zeke mentions another, equally dangerous, problem. Once asteroid Amalthea is blown free, Endurance's mass will hugely decrease and allow for incredible acceleration. However, this loss of mass will put all-new stress on Endurance's structure, and the addition of Red Hope's heptad might prove too much. Ivy, if for no other reason, is against abandoning Red Hope because she wants those supplies.

Aïda requests amifostine (a drug to protect against radiation) and water, but Ivy cannot comply because all MIVs have been stripped for parts. Ivy and Zeke—the pilots—inspect radar signatures around Cleft, and have now a better idea of what level debris to



expect. Aïda's Red Hope heptad is now picked up visually, but she gives only a 30-second warning when a braking thruster runs out of fuel. The vessel collides with Endurance, depressurizing a section and flinging space-walking Michael Park into the void. Aïda radios that she will try again at an undamaged docking port, and Moira shouts to not let the crew dock—it's a trap. Red Hope docks. Ivy calls warnings, then detonates the explosives releasing Amalthea. Zeke radios from the dock that they're under attack—Steve Lake has been shot by Julia's revolver, and after a few minutes the solar storm hits.

Zeke, Tekla, Luisa, and bald Julia somehow make it alive into the Hammerhead. Zeke says they managed to kill four of Aïda's crew, and badly injured two others, which leaves her and three more to deal with. Zeke explains that Aïda's plan was to attack while Endurance's crew were tucked into their storm shelters. Inspecting Julia, Dinah cries out when she sees the former-president's tongue has been pierced by a stainless steel bolt roughly two inches long and anchored with nuts and washers above and below. Dinah and Ivy remove the bolt, and Julia sounds weirdly normal, as if addressing the media from the White House briefing room.

Julia reports that after she surrendered to Red Hope's crew, they took her gun and tortured Spencer Grindstaff to reveal his passwords and insider knowledge of Izzy's IT systems. Then they killed and ate him. Steve Lake was shot because he was the only one qualified to stop Red Hope's resident hacker from cyber-jacking Endurance's mesh network. The big engine burn takes nearly an hour. A kilometer-long moon slice tumbles past barely 300 feet away. Parambulator aids Ivy to steer around larger rocks. The Endurance crew has no way to determine the status of the battle with Red Hope survivors, as the system automatically seals off bolide-damaged sections. Zero-gee abruptly returns, signaling the end of the burn. Ivy pilots the ship hundreds of kilometers into the Grand Canyon-like crevasse, until reaching a zone so narrow there is no threat from lunar debris or radiation. Endurance will land, forever.

In Chapter 12, Ivy switches off the thrusters and Dinah sends robots to weld Endurance permanently to iron Cleft. Tekla soon joins these looking for Red Hope crew. After two days, Aïda is found starving and slightly injured, but otherwise healthy. Humankind now totals 16, some suffering from radiation sickness. Dubois dies, body frozen for storage. His—and the others'—accounts are saved for future historians. The three-year backlog of email, Facebook posts, and blog entries that gathered when the Swarm's mesh network recombined with Endurance's, tells a tale of Julia and some of her followers losing touch with reality. Aïda's "Black Bolo Brigade" rejected this nonsense and demanded from Julia a full accounting of supplies.

One week later, after the last victims die, only eight humans are alive: Ivy, Dinah, Moira, Tekla, Julia, Aïda, Camila, and Luisa. This later will be called The Council of the Seven Eves, even though eight women presided; Luisa, though, had reached menopause. Privately, the Endurance veterans know Julia is harmless, but agree Aïda is not. She will be carefully watched. Moira takes over, and reports all of the precious genetics lab equipment functions; the only way to make babies is parthenogenesis, by which a uniparental embryo can be created out of a normal egg. This method will take years to



set up and become optimal. In the event of her death, Moira has created instructions accessible to the others.

The discussion becomes confrontational after Moira admits DNA can be manipulated to eject "bad" traits like aggression and mental illness. Tekla counters that aggression is positive when tempered by intelligence and discipline. Dinah taps on the view-port, and the others see that she has attached an explosive device there, set to detonate in ten minutes if they don't come to some agreement. It is agreed that each woman will be allowed a single DNA manipulation, either to add or remove a specific trait. Ivy gives Dinah a thumbs-up, and the blinking device is flung into the starry sky where, after a few moments, it blazes sunny yellow in a silent explosion.

Analysis

Chapters 10-12 comprise the rising action, climax, falling action, and denouement of the main plotline in *Seveneves*. This section of the novel builds in tension as the main protagonists attempt to make their way to Cleft and in doing so, save the human species from extinction. The themes of collectivism, reproduction, rebirth, exploration, and survival all culminate in the conclusion of Part 2 of the novel.

Markus, Ivy, Dinah, Salvatore Guodian, Zhong Hu, and Moira are subjected to former U.S. President Julia's narrative about losing her family and office and country in a single day. There is no sympathy from anyone, and Julia is shocked by this disrespect—and, in a turn of irony, kicked out of the meeting. Moira admits that only 3% of the HGA survived the module damage, but that her genetic instruments can produce a DNA strand from digitally coded material on her thumb-drive. This revelation foreshadows the success of the mission and the establishment of the Seven Eves.

The themes of political corruption and the media's skewing of the truth are explored when Markus says the whole HGA was nothing but a political ruse. Dubois says the Ark population is sufficient to ensure diversity, thus lowering the chances of birth defects in "clones." But Moira's equipment cannot be unpacked in zero-g, so this must wait until establishment of permanent habitats. The author layers these "political" discussions so adroitly that the reader must invest considerable thought about who to believe; not a frequently encountered device in speculative fiction.

Moira states much will depend on Sean Probst's water- and nutrient-rich comet being delivered, and here Markus admits to intercepting Sean's "secret" messages to Dinah, and that Ymir is coming in "hot, high, and heavy." The commander saves the worst for last: that was Sean's final message. He and Ymir's crew are dead. Someone must venture out, retrieve the ship and comet attached to it. Again, a very potent example—among many—of what can go wrong in space, and the demand placed on respondents to react at once in a mode of hyper-competence and utmost resolve. This mission catapults the plot into high gear as it builds toward the climax.



Markus volunteers to form a crew composed of himself, Dinah, nuclear engineer Jiro Suzuki, and cosmonaut Vyacheslav Dubsky. The ship will be called New Caird, after the small rescue boat used in 1916 by the Shackleton Antarctic expedition. This is one of many allusions to Sir Ernest Shackleton in the novel, and reflects the themes of survival and exploration. The Imperial Trans-Antarctic Expedition, also known as the Endurance Expedition, is known as the last of the Heroic Age of Antarctic Exploration.

The reader becomes aware that Markus isn't the cold-blooded paranoiac he appears, and is driven by a desire to protect the human race's legacy. Reaching Ymir in the quickly improvised New Caird, the crew is confronted by what appears to be a giant anthill of black ice. All members of the Ymir mission are found dead: Sean from bleeding out through the anus due to ingesting beta radiation in the food; Larz Hoedemaeker (Dinah's contact from Arjuna Expeditions) too from radiation poisoning, and another man in an accident with the huge auger used to tunnel through the comet to make a chamber for the nuclear reactor which malfunctioned and killed everyone, and must be repaired by Jiro. These scenes are especially dark and claustrophobia-inducing, and the author draws them with deadpan, almost flat, prose. The effect is pronounced, more so than the clipped sentences usually employed in portraying danger and high-seriousness.

The character development of Julia Flaherty takes center stage in Chapters 10-12, and with it, the development of the themes of corruption, power, and politics. Julia, now trained to survive in space, resides in an arklet with 28 younger people who follow her like cult members and want to colonize Mars. She is reunited with 18-year-old Camila, who survived a gunshot to the jaw during an assassination attempt while fundraising for the schooling of Muslim girls. Ex-NSA network tech, Spencer Grindstaff, makes his hacking skills available to "Madam President" to ensure privacy during policy meetings. The author thus shows how corruption spreads even during disastrous times—or especially then.

Julia complains to former NASA astronaut (now security man for Markus) Zeke Petersen that she deems it unfair that the Ark GPop gets to vote on which arklets get protective placement in asteroid Amalthea's shadow. Zeke has been sent there to spy for Markus, and says no one anticipated heat from the burning Earth would expand into space and threaten the Ark, so those closest to the exosphere must have priority. Zeke is not an aggressive observer, and his actions reveal self-division and guilt. He's out of his element, and the reader wonders why Markus chose him for such a role. Later in the narrative, Zeke's true value shines. He is one of the very few who survive, with the Seven Eves, the fraught journey to Cleft.

Tensions further develop as Markus realizes he must rely on optical instruments and split-second thruster firing to slow down the massive comet in order to safely deliver it to the Cloud Ark. Sean's parameters won't work. Worse, Dinah's robots must reshape the thruster nozzles installed all over the comet. Back on the Ark, conflicts emerge between Dubois and Julia when Dubois informs her that NASA already studied and dismissed a Mars mission—it takes six months and uses impossible resources. Julia's



techs disagree, telling her all they need are 10 stacked arklets and the supplies they've been hoarding.

Zeke visits and returns to tell Markus that Julia is insane, now claiming the Parambulator (an app that provides a view of all Cloud Ark vessels) is a control tool under the guise of public safety. Social worker Luisa Soter thinks the former President is suffering from PTSD, but probably has always had some sort of narcissistic personality disorder. Here, author Stephenson reveals the machinations possible when intelligent fringe groups are ignored and/or belittled by mainstream authorities.

Julia is considered no real threat, but Tekla is assigned to make an official security visit to warn that tampering with the Situational Awareness Network can have grave results. Unaware that the meeting area (the Banana) has been bugged by Grindstaff, Ivy and Tekla agree that Tekla should offer herself as a "mole" to Julia's camp, then report back with updates. This example of dramatic irony in the narrative builds tension, as the reader is aware of important facts that the characters do not know.

On Ymir/comet "Greg's Skeleton," Jiro repairs the nuclear reactor but, along with Vyacheslav, soon dies from radiation exposure. These, as with many other deaths in the narrative, emphasize the theme of sacrifice. The protagonists in *Seveneves* have little choice but to face and accept death in order to have any hope for the propagation of the species. In a move that aims the comet toward the Ark, Markus is killed by a rogue thruster burning through New Caird's hull, leaving Dinah alone to pilot the Ymir. The author illustrates Markus as a tragic hero, and leaves a few hints that Markus knew there would be no surviving the thruster firing. His death too represents the theme of sacrifice.

On the Ark a meeting is held by contingent commander Ivy and the other "admin" regarding Julia. Ivy offers a 24-hour period of amnesty to anyone returning stolen supplies, but Julia and assistant Paul eavesdrop and plan to hijack the Ymir rescue vehicle and call it Red Hope. This new conflict builds tension toward the climax of the narrative. As they prepare, zip-tying dock workers and securing the ship, Tekla and her security team arrive, and Julia fires a round at Tekla with Starling's revolver but instead injures Camila who came to warn of an incoming bolide picked up on sensors. The bolide, symbolizing the power of nature, strikes the "Caboose" and kills 300 Arkers. Julia and her faction depart on Red Hope and are followed by 800. This departure presents an obstacle for the remaining survivors to push past the moon's orbit, but Dinah has managed to deliver enough ice to propel them.

One month later the Cloud Ark is rechristened *Endurance*, another allusion to Sir Ernest Shackleton and his ice-bound wooden ship, *The Big Ride to Cleft* begins. This mission marks the final ascent toward the narrative plot's climax. The projected one-year journey takes three years instead, and many commit suicide—Rhys Aitken among them. These deaths symbolize the emotional toil that the characters have undergone up to this point. Even the hope of the mission's success is not enough to sustain emotional health under such dire conditions.



Dubois is going blind and has cancer, but is philosophical about death. The population skews toward women, which returns to the theme of femininity and the symbolism of reproduction and the moon. Women have been deemed better withstand pressure, both psychological and physical, and men require more food, oxygen, and personal space.

From the long Cold War between Julia's Red faction and Endurance's Blue, a young Italian woman named Aida contacts Dubois and requests her ship be permitted to join Endurance. This is allowed, as the Blues cannot ignore any last vestige of humankind to perish. But it's a trap, figured out too late after the ship rams Endurance and flings Michael Park into space. Floating to his death, Michael absurdly checks his email and locates an old message tipping him off. This action references again the motifs of social media and humanity's disconnection for the real in favor of the virtual world.

In the climax of the narrative plot, all of the invaders—excepting Aida—are killed. Julia is found with a bolt piercing her tongue, and after this is removed tells of being taken over and of Spencer Grindstaff being tortured for passwords then killed and eaten. Julia rejoins the Blues. The author shows Julia in her final evolution, as a repentant Eve. Thus, Julia's character arc makes its completion and a resolution is reached in the major conflicts in the main plot.

When Endurance lands on Cleft, it is permanently locked down and becomes a building-like structure planned for expansion to capacitate coming generations. This landing foreshadows the events in Part 3 of the novel, wherein the human population has, in fact, survived. Dinah takes Dubois for a final walk, after which he dies. The Seven Eves meet (Luisa has passed menopause) to decide their fate, but outside Dinah attaches an explosive device timed to detonate if they don't come to a unanimous decision within 10 minutes. The Seven Eves choose life. Author Stephenson leaves the reader to ponder what happens next, but there are many clues scattered throughout the coming pages.

Discussion Question 1

After most of it is destroyed, Markus Leuker tells Doctor Dubois that the Human Genetic Archive is nothing but a "political ruse." As commander of the Cloud Ark Swarm, why does he say this?

Discussion Question 2

Former U.S. president Julia Bliss Flaherty is an unstable, complex character, but probably insane after illegally fleeing Earth and joining the Red faction. Ultimately, 800 of them follow her on the Red Hope mission to Mars. Why? What did she offer that convinced so many to venture into open space?



Discussion Question 3

On *Cleft*, the last scene set in our present time, only eight women survive. They meet to decide how the human legacy will be sustained, but Dinah goes outside and attaches to the viewport an explosive device timed to detonate in 10 minutes—unless they make a unanimous decision. Discuss why Dinah does this.

Vocabulary

algorithm, finesse, decentralized, nuanced, ecliptic, truss, flux, matrix, blight, apogee, crevasse, perigee, superimpose, starboard, cudgel, spiritualism, dodgy, genotype, psyche, terminator, chivalry



Section 5, Chapter 13—Epilogue

Summary

Chapter 13 moves 5,000 years into the future. Kath "Two" Amalthova, employed by TerReForm to survey New Earth's ecosystems, is waked by a pattern of lights dazzling her tent. Earth, terraformed by the planned bombardment of icy comets and other methods, has only in the past few decades been seeded with life, some of which is predatory. Occasionally, Survey sightings of anomalous people are reported, but these are hard to figure, as Sooners (illegal visitors from the habitat ring) confuse the issue.

The habitat ring houses three billion, with Greenwich being the first joint project of all seven human races descended from the Seven Eves: Ivyns, Dinans, Moirans, Teklans, Julians, Camites, and Aïdans. The other geosynchronous habitats are Volta, Banu, and Qasim to the east; Atlas and Roland to the west. Later, more are constructed in both directions: Rio, Memphis, Pitcairn, Tokomaru, Kyoto, Dhaka, and Baghdad. All knowledge and accounts from Old Earth are archived in The Epic, without which new humankind could not have reclaimed the dead planet. The First Treaty stipulated guidelines for all TerReForm activity, and paved the way for the Great Seeding of trees Kath Two would fly over decades later. Tremendous technological assets had to be deployed, resulting in the Second Treaty, drawn up to limit the number of robots allowed both Red and Blue. The most tech-adverse, Amistics, will accept only certain enhancements.

Kath Two looks to the urban glitter of lights in orbit—the Great Chain, circling the Eye crafted from Cleft's metal core. Soaring over a blue lake, she is startled by a human figure poised before the tree-line who—seeing Kath—drops back into shadow. On shuttling Flivvers, members greet one another with salutes identifying their particular race. Kath greets a Teklan, Beled Tomov, whose salute signals "I am not going to kill you with a concealed weapon."

Rhys Alaskov notes that New Earth's canid population has "gone epi" (epigenetic), with coyote-like animals hunting in packs like wolves, and "family pets" going feral. Epigenetics allowed life-forms to develop according to nano-decisions and environmental circumstances, instead of relying on randomness in DNA that might favor some "junk" genes with locked-in codes.

Kath Two, Rhys, and Beled represent a Fourth Millennium with vast ambition geared toward undoing the ruin inflicted against humankind and the moon by the Agent. Through identifying, cataloging, reaching, corralling, and re-vectoring millions of rocks in orbit around Earth—plus icy comets rich in water and methane adrift in the Kuiper Belt—they hope to progress, and constantly build hulls and other structures out of recycled and melted-down robots. Kath asks Beled whether on this last Survey he saw any Indigens: Sooners allowed life on the surface within Registered Indigen Zones, as laid out in the Treaty.



Finally, in Quarantine, the three workers are inspected visually for invasive species and pathogens, clothes and equipment sterilized followed by mandatory showers and scrubbing. In a café, a Julian woman engages her in conversation and Kath knows this is a Quarantine agent probing for something. The woman satisfies herself that Kath's report was honest. Kath enters a simulation of an Old Earth Louisiana bayou and exits into a stand of 800-year-old Douglas firs. Here, she finds Doc and a few students poised on logs and rocks. The students (excepting Memmie, Doc's transgender Camite assistant) depart, and Doc tells Kath he needs a Seven for a mission on Earth—Kath. So far only five Sevens have shown: Kath, Doc, Beled, Memmie, and Kath's Quarantine spy Ariane Casablancova, whom Kath is not trusting.

Cradle is suspended from 36,000 kilometers of dauntingly complicated cables, themselves swarming with robots performing constant maintenance. Cradle holds a memorial for Doc Dubois, Zeke Petersen and, of course, the Seven Eves, and is partly formed from Cleft. Kath wanders the Old Earth-city replica, and finally locates the meeting place: The Crow's Nest South Cradle, a tavern/café. Ty, the Dinan barkeep and owner, leads Kath to a small room with an oval table, around which wait the others—one of whom is a Neoander named Langobard. Later, the group boards a glider body-piloted by Kath, and spends the better part of a day flying west to Magdalena, an island TerReForm station. On these were created and tested the first life forms, isolated from continents until successful enough for release. Vigilant Ariane doesn't favor the cheering crowd running toward Doc's exit from the glider. Ark Madiba, a massive transport vehicle, delivers the group to Mokupuku, another isolated TerReForm station located near Old Earth's Hawaii. After a night's rest, they travel north to Blue Antimer, another base, and then to the near-Alaskan Qayaq, a base built on a vast slab of ice. At a bar in the adjoining town of Beringia, the group is approached by a young bearded man, Einstein, who tells them he can show off a fascinating artifact across the mountains.

Later, the group encounters the most isolated landscape yet. Einstein leads the group to a pit where they find a 5,000-year-old radiator hose, and a broken Craftsman shovel. Even Doc is surprised, and now reveals this area has become the new focus of their mission. When "Diggers" are encountered watching the group, the only explanation is that these people are descendants of miner Rufus MacQuarie's people who went underground during Hard Rain. The two groups—Spacers and Diggers—meet. To Ty, these people look exactly like those seen in archival videos and images from pre-Agent times, with paler eyes and skin from living mostly underground, and freckles from infrequent sun.

From his reinforced wheelchair, Doc makes a peace offering of the broken shovel handle. A Digger woman accepts this, smashes Memmie's temple, and drives the sharp end into her neck. Ty takes the shovel handle and clamps by the throat the Diggers' elder against himself as a shield. Ariane subdues Memmie's killer, and both are scooped from the ground by a Thor, an exotic device deployed from space. The Spacers (excepting escapees Bard and Beled) want no further problems, and allow themselves to be taken captive. Doc dies from a stroke suffered during Memmie's murder.



Ty understands that Ariane was a Red (Swarmer) mole, and probably will be lauded and promoted for abducting a genuine descendant of Old Earth rootstock. Donno says he wants the Spacers gone, and Ty (using sentient crows brought from the ring habitat) sends word to Beled and Bard. Donno declares that his human race owns all Earth, not the mutant Spacer freaks. Einstein asks about the oceans, and is told he'll have to take that up with the Pingers—the sea people. A legion of drop pods streak down like meteorites, and land. Soldiers emerge from these and later deliver Marge, escorted by Ariane. Between them on a pole dangles a chunk of iron asteroid as a peace-offering precious to the Diggers. Bard and Beled return and free the others, including feverish, dozing Kath. Cyc wants to go South toward the ocean with the Spacers, and informs them that the Pingers left a cairn on the beach, indicating a desire to communicate.

During the trek, Cyc (Sonar Taxlaw) explains that she is a non-breeder, selected instead to be either a Micropædia or Macropædia: 30 Diggers who memorize and comprehend the set of Encyclopedias Rufus MacQuarie had had the insight to leave behind. Special Ops crews come down and give medical care, especially to Kath, who transforms into hyper-aware physicality and jumps naked into the freezing sea. Kath (now Kathree) and Bard, on the beach, discover black slates and chalk the Digger leaders have been using to communicate with the Pingers. When Cyc and the others catch up, the Digger girl explains the Pingers' evolution from humans into amphibious humanoids.

ISS commander Ivy Xiao's fiance, Cal Blankenship, and his nuclear submarine crew, had taken refuge in a deep sea trench to survive Hard Rain. Once the Pingers became aware of new breathable atmosphere, they surveyed and discovered the Diggers, and began a cautious exchange of technology and data. Later that night, after a Morse code signal tapped out by Ty, a massive barge-like vessel rumbles near shore, erects a tall stand of lights and antennae, and delivers a news reporter who interviews everyone (including Special Ops members Esa Arjun and Roskos Yur), then introduces herself to Kathree as Cantabrigia Barth Five.

Cantabrigia allows Kathree to wear her varp system, in which she witnesses rising from the sea a colossal curved object connected to the Red's orbiting Kulak asteroid. On the Earth end, the massive "Gnomon" is situated between Borneo and Sulawesi, and cause of a rift with the Pingers, due to destructive sea-bed mining. Because of this tremendous mistake, the Reds want to give Diggers luxurious treatment and are planning to ambush the Seven survivors on the beach. Kathree is warned, and to tell the others, not to harm any Diggers nor disturb any recording device. The Red Neoanders who earlier landed in pods arrive in darkness. The Neoanders use robotic whips to destroy a few buckies, and Kathree talks a Digger archer out of launching an arrow into her. The battle ends with some Reds retreating, others presumed dead, and at least one being zip-tied by Bard. On a small islet, Ty, Einstein, and Cyc use a sonar device brought down by the Special Ops team to summon the Pingers: two women and a man. Other Pingers emerge, and gingerly inspect Ty and the others. Video journalist Cantabrigia appears satisfied.

In the Epilogue, Ty, Special Op Esa Arjun, and Deep—a Pinger—share lunch. Ty questions Esa, as he cannot believe Cal Blankenship and his unlikely descendants



could possibly have survived inside a submarine for as long as the Epic claims. It is revealed that Cal sent to Ivy 17 more "selfies" that suggest the government had had a contingency plan for a very long time, and might have prepared certain areas well in advance of Hard Rain. Einstein and Cyc join them and Einstein demands to know what people mean when they mention the Purpose. Ty says he doesn't know, but suspects it's simply a ploy to help people feel better, like Old Earth religions without theology. In a way, Einstein has replaced Doc Hu Noah. Cyc has filled Memmie's shoes, and now loves Einstein. Ty proposes forming the first Nine in history. At Cyc's shocked exclamation, Ty backs down, admitting that it's easier to ask forgiveness than permission, but they're all welcome.

Analysis

The narrative in Part 3 of *Seveneves* moves 5,000 years into the future, with a habitat ring now established and populated by three billion people descended from the Seven Eves. This transition has left behind the main protagonists and replaces them with new characters and a new storyline. The themes in this section of the novel, however, carry across from the previous narrative. Themes explored in these chapters include survival, exploration, collectivism, and rebirth.

Kath Two is introduced as a member of Survey, a group tasked with monitoring the seeded ecosystems of New Earth, only now beginning to teem with mammals and other life. Here, the author employs simile, metaphor, and other imagery to describe a setting completely unlike those seen before in the novel. Precise bombardment of icy comets has replenished oceans and lakes and rivers. This "terraforming" has also created a breathable atmosphere, the entire process aided by robot swarms of endless variety, just as quickly recycled into other forms and functions. The author maintains a realistic ambiance, no matter how strange. A new form of nanotechnology is in place, allowing fantastic fusions of the organic and cybernetic.

Kath is aware of sighting reports of anomalous humans—odd-appearing types far outside approved zones. She spots one herself, and the figure ducks back into deep forest. This encounter foreshadows the discovery of the Diggers, the Pingers, and other groups that have survived, isolated on the planet, since Hard Rain. The New Earth could not have been created without the digital Epic handed down from the Seven Eves, and chronicling the first new human generations, and a wealth of technologies.

The guided evolution from the Seven Eves has resulted in disagreements, even war, between Red and Blue factions, and Treaties ended these, but not an apparently eternal human tension between desire and reality. The aged Doc Hu Noah (whose name is yet another Biblical allusion referencing Noah and the flood) forms an expedition that lands on Earth near what used to be known as the Alaskan wilderness. The goal of this mission is that of verifying the reports of anomalous humans. These might be nothing more than rogue Sooners, those who make illegal visits to the surface but eventually are left alone.



Author Stephenson plants seeds of curiosity about the origin of these apparent unknown people, and this looms over the narrative and drives the hauntingly recognizable characters descended from Ivy, Dinah, Tekla, Moira, Camila, Aïda, and Julia, each of whom agreed to make one trait alteration to their genome. The Teklans are aggressive and physically strong, but essentially quiet and not impulsive like their Eve. Moirans are inquisitive; Julians visionary and daring; Dinans can be brave but prefer their own company. Eve Ivy's race shares her sensitivity and sense of duty. Camila's descendants are servile but never passive, and Aïdans make great disrupters and tricksters—but don't turn your back on them. These qualities represent the strongest traits in the original protagonists, and can be seen in the main characters in the second plotline.

Doc Hu Noah's Blue team—Ty, Rhys, Kath Two, Beled, Langobard (a neoander), Ariane and Memmie—a "Seven," meet Einstein, born on New Earth, in a rough port bar. Einstein's name, derived from Albert Einstein, foreshadows the important role he will play in the achievement of the mission. He leads them over the mountains where he claims to have discovered Old Earth artifacts—among them an 18-wheeler truck trailer. However, the site is found to be unearthed, but a radiator hose and broken shovel are found—the first ever relics from before the Agent, and symbols of humankind's history.

The team is attacked by Diggers, who prove to be descendants of Rufus MacQuarie, and somehow survived for 5,000 years underground, until coming into the open upon their scouts' detection of breathable air. Memmie is killed in the attack and Doc is rendered useless from a stroke which soon kills him. The Spacers are shocked and horrified at this attack on what ought to be a historical and sacred meeting. This ironic event sadly solves the mystery sightings of anomalous humans. A Red spy, Ariane, summons a space device (a Thor) which sweeps her and Memmie's killer into space for interrogation (and Ariane's reward).

Einstein and Kath are chained together, and Langobard escapes with Beled and Rhys. A teenage girl, Sonar Taxlaw, helps them escape and joins the group. Sonar Taxlaw is a virtual "Cyc," or encyclopedia raised on the much reproduced encyclopedias of Rufus MacQuarie. The Diggers agree to let them go. At the sea, a news team arrives to interview the team, but conflicts emerge when the Reds return and start a battle. Rhys is injured. Einstein later summons a trio of undersea Pingers, descendants of Cal Blankenship, and they are friendly.

Later, Ty, Sonar Taxlaw, and Einstein have lunch with one of the Pingers, Deep, who seems to understand them when they decide to form another team with the other survivors of Hu Noah's group and some Special Op soldiers. Ty admits he doesn't know the "true" meaning of the mysterious Purpose, that perhaps it is nothing more than a way to give people hope, a substitute for a race who has tossed out religion. At length, it is understood that yet further disagreements and even violence—seemingly embedded in DNA and collective consciousness—will forever mark the races of humankind, wherever they may travel. After all their hardships, the others are glad to accept this. Stephenson's circular narrative leaves the reader neither hopeful nor despairing: humanity will survive, disagree, and love until the next end.



Discussion Question 1

Kath Two is capable of "epigenetic shifts" both psychological and physical, induced by trauma. Why is her particular race (one of seven) the only possessing this trait?

Discussion Question 2

The Digger Donno declares Spacers Ty and his earth-born guide Einstein to be "monsters." Why?

Discussion Question 3

The Pingers, descendants of Cal Blankenship, nuclear submarine commander, remain mysterious in the narrative. How did they survive and evolve?

Vocabulary

inflection, gambit, discourse, epicanthic, zenith, ambient, islet, timbre, implicit, aboriginal, stymied, concentric, rootstock, cloistered, lapse, fuselage



Characters

Dinah MacQuarie

Dinah MacQuarie appears as one of the main protagonists in Parts 1 and 2 of *Seveneves*. When she is first introduced, Dinah runs a robot "shop" on the International Space Station (ISS/"Izzy"), and has a background in mining, engineering, and computer science. She is tough, sexy, fiercely intelligent.

Dinah is the daughter of Rufus MacQuarie, a mine owner and underground survivor on Old Earth whose descendants are Diggers. In Part 1, Rufus sends Dinah a message by Morse Code to inform her of the fragmentation of the moon. Soon thereafter, once the impact of this event is revealed, Dinah's role on the ISS becomes more central to the plot.

Dinah works for entrepreneur, founder and chairman of Arjuna Expeditions, Sean Probst. After the Cloud Ark project is underway, Sean Probst arrives on Izzy and relates a new mission: he intends to capture the comet called Greg's Skeleton in order to make the Ark fully sustainable for future generations. Dinah's role in this mission is vital, as her robots must be manipulated to mine ice from the comet once it has been acquired.

Dinah is one of eight characters who survive *The Agent*, and all that follows after the destruction of Old Earth. After Greg's Skeleton has been acquired and the Ark makes its way to Cleft, Dinah becomes one of the Seven Eves.

Ivy Xiao

Ivy Xiao is an American astronaut and the Commander of International Space Station at the time of the moon's collision. Among the final surviving Seven Eves of the novel's eponymous title, Ivy is decisive but inwardly fragile. Dinah is Ivy's closest friend.

After the revelation of the moon's fragmentation, Ivy expresses sorrow and desperation in realizing that she will never see her fiancé, Cal Blankenship, again. Ivy's scheduled return to Earth is cancelled because she is needed to command Izzy during its transformation to the Cloud Ark.

After the moon's fragments enter into the Earth's atmosphere, resulting in White Sky, Hard Rain, and the extinction of most of humanity, Commander Ivy Xiao is replaced by Markus Leuker as the leader of the ISS. She suspects this might have had something to do with her hand in rescuing the Russian woman, Tekla, from certain death in the airlock.

After President Julia Flaherty arrives, illegally, on Izzy, conflict emerges between Julia and Ivy, as Ivy is enraged that the President endangered the entire mission.



Later, Ivy pilots the Endurance as it lands on Cleft. Ivy is one of the survivors that becomes known as the Seven Eves. Meanwhile, it is revealed in Part 3 of the novel that her fiancé, Cal Blankenship, has survived on Old Earth and begun the Pinger race.

Julia Bliss Flaherty

Julia Bliss Flaherty is the President of the United States at the time of the moon's disintegration. Julia affects an in-charge demeanor, but is an insecure narcissist and political opportunist at every turn.

Julia manages to maintain global peace in the aftermath of the moon's initial fragmentation, and orders Dubois Jerome Xavier Harris, Ph.D. to the Cloud Ark in order to maintain a positive media presence regarding the project.

Julia illegally flees doomed Earth and is rescued in space from a damaged craft that endangers the entire Cloud Ark Swarm project. This action causes conflict between Julia and former Commander Ivy Xiao.

Later, Julia joins a group of young rebels who break away from the Ark and want to colonize Mars. The group follows Julia's wisdom and forms a sort of cult, but Julia mentally implodes and the Red Hope mission returns to attack the Ark.

Julia survives and makes peace with the other survivors who eventually manage to land the spacecraft Endurance on Cleft. Julia goes on to become one of the Seven Eves.

Tekla Alekseyevna Ilyushina

Tekla Alekseyevna Ilyushina is a Russian worker, former Olympic athlete, test pilot, and cosmonaut. Tekla is stronger than most men, and mysteriously silent most of the time. She is one of the first Scouts sent up with the Cloud Ark construction crew that is tasked with hazardous space-walks and outside modifications to the ISS.

Dinah becomes fascinated with Tekla, and is the first American to befriend her. The Russian is slightly disfigured in an airlock/rescue incident organized and carried out by Dinah. However, despite the fact that Dinah has saved her life, Tekla shows little regard or appreciation, having come to view herself as nothing more than an expendable worker.

Tekla becomes the focus of pornographic interest to men and women on Earth as the countdown to the end of humanity begins. Tekla patiently gains respect and eventually is selected to join Markus' security team.

Tekla survives (barely, after being stabbed by Aida) to become one of the Seven Eves. Her survivors, known as "Teklans," become one of the seven races in Part 3 of the novel. Beled Tomov is a descendant of Tekla's race.



Dubois Jerome Xavier Harris, Ph.D., aka "Doob"

Dubois Jerome Xavier Harris, Ph.D. is a television popularizer of science who also mentors a group of Caltech graduate students. Dubois' character is akin to popular contemporary television personalities Neil deGrasse Tyson and Bill Nye.

After the Agent disintegrates the moon, Dubois meets and marries a teacher, but is literally ordered by President Julia Flaherty to go into space and join the Cloud Ark as its "cheerleader" to assuage mass anxiety and panic on Earth. Doob survives with the Seven Eves, but ultimately dies of cancer after they land Endurance permanently on Cleft.

Camila

Camila is a young female Arker and a survivor of an assassination attempt on Earth. During a fundraising tour for the education of Afghani girls, Camila was seriously wounded by a shotgun blast to the jaw.

Given political asylum by the Dutch, Camila is chosen to be sent to the Ark as a rebuke to some conservative Muslim countries who had refused to nominate female Arkers unless given assurance that arrangements would be made for them to live in orbital purdah.

Camila does not adopt Western ways, and is secretly in love with Julia Flaherty, who parades the coy girl around at dinner parties and official functions. Camila saves Tekla from being shot by Julia and is wounded. She becomes one of the Seven Eves.

Moira Crewe

Moira Crewe is a geneticist on the Cloud Ark charged with maintaining the Human Genetic Archive. Of West Indian descent and raised in London, Moira possesses a restless intellect, but is intimidated by her tremendous responsibility. Ultimately, after the destruction of the HGA, she saves humankind by decisive application of everything she has learned, and leaves detailed instructions for others in the event of her death. Moira survives to become one of the Seven Eves.

Aïda Ferrari

Aïda Ferrar, an Italian woman in her early twenties, is a member of the anti-Julia Flaherty brigade on the Red Hope mission. Socially weird, hyper-acute, and exhausting with a lacerating sarcasm, Aïda hatches a plan to seize the ship Endurance on its way to Cleft. Her actions get her crew killed, and Aïda falls into deep depression. Later, she becomes one of the Seven Eves.



Luisa Soter

Native New Yorker and social worker, Luisa Soter is referred to as "the first shrink in space." She has a difficult time adjusting to the culture, such as it is, but an easy self-confidence allows her to admit she knows nothing about technical matters. With many on the Ark bordering on an Asperger's level, Luisa realizes that asking questions is a good way to open them up. Luisa survives with the Seven Eves, but cannot contribute offspring because she's passed menopause.

Markus Leuker

Former Swiss air force pilot and now astronaut, Markus Leuker is sent to the International Space Station under the "Gpop" policy, as a skilled specialist deemed vital to the project. After the Hard Rain destroys Earth, Ivy is demoted and Markus is appointed commander of the Cloud Ark Swarm. Seemingly cold, Markus actually is dedicated to preserving the human race, and sacrifices himself during the New Caird mission sent out to intercept Sean Probst's comet.

Sean Probst

Sean Probst is Dinah's boss and the founder and chairman of Arjuna Expeditions. Perceived early on as a self-obsessed entrepreneur, Sean ultimately perishes on a critical space mission to retrieve a water and nutrient-rich comet that saves humankind from extinction.

Rufus MacQuarie

Rufus MacQuarie is the father of Dinah and of the underground Diggers who survive on Earth 5,000 years into the future. An Alaskan mine owner, Rufus communicates with Dinah via Morse code tapped out on an antique telegraph key. She has the same setup on the International Space Station. Rufus and a large group expand an existing mine and stock it with provisions enough to last at least one generation, then weld themselves behind a massive hatch.

Kath Amalthova Two

5,000 years after the Seven Eves settle on Cleft, Kath Amalthova Two is a Survey member employed by TerReForm. Kath's team is sent on two-week shifts to monitor New Earth's emerging ecosystems seeded from space and the habitat ring. Nanotechnology enables Kath to don an inflatable suit that becomes a powered glider. Eve Moira's long-ago genetic manipulation of Kath's line causes "epigenetic shifts," which alter Kath's form in mostly subtle ways sparked by environmental challenges and emotional/physical trauma.



Doc Hu Noah

Aged genius at the apex of TerReForm, Doc Hu Noah spends most of his time mentoring and researching, and is tended by Memmie, a descendant of Camila. Doc ventures to Earth with Kath and a Seven team, under the guise of investigating sighting-reports of "anomalous" humans in what used to be the Alaskan wilderness. Doc dies after trauma from witnessing a female Digger murder Memmie during a peace offering.

Tavistock Prowse

Tavistock Prowse is a video journalist and colleague of Dr. Dubois. Prowse is present at the historic Crater Lake announcement when world leaders tell the masses about the looming end to come. Later, Prowse joins former U.S. President Julia Flaherty when she breaks away from the Cloud Ark for Mars, and becomes one of the first space-bloggers. He comes to a bad end by way of cannibalism.

Beled Tomov

Beled Tomov is the bartender/manager of the Crow's Nest, where the Seven team meet before heading out with Doc. Shrewd and secretive, Beled falls for Kath, and is rumored to be in league with members of the enigmatic Purpose. He proves to be a handy martial artist, and is with Einstein during the first contact with Pingers.

Einstein

A young bearded man born on New Earth, Einstein guides the Seven team into the wilderness where he claims to have discovered artifacts from Old Earth. Einstein also claims that he might know the location of Rufus MacQuarie's holdout. Einstein makes first contact with the Pingers.

Rhys Aitken

Rhys Aitken is a British engineer sent into orbit to build spinning tori to provide simulated gravity on the Cloud Ark. Rhys falls for Dinah and they have a satisfying sexual relationship. He assists her with insights on her robot designs.

Zeke Peterson

Zeke Peterson is a former NASA astronaut and straight-shooting John Glenn type who becomes head of Cloud Ark security. Strong and reliable, Zeke dies much later on the Cleft mission that saves the Seven Eves.



Spencer Grindstaff

Spencer Grindstaff is a National Security Agency network/communications specialist assigned to ISS on Day One. Spencer is an old-school CIA-trained "spook" who begins with good intentions, but later joins up with Julia and hacks into the Ark's security system to provide her with private meetings. Spencer places a listening device on the Ark, which allows Julia to overhear admin discussions. Several years later, Spencer is tortured by Red Hope crew for IT wisdom and passwords. They kill and eat him.

Sonar Taxlaw (aka "Cyc")

Sonar Taxlaw is a Digger who flees the holdout to join Einstein and the Seven team. She is one of 20 "macropedias" who have read and memorized the entire set of encyclopedias left by Rufus MacQuarie. Sonar brings clarity to the Old Earth language and ideas.

Vyacheslav Dubsky

Vyacheslav Dubsky is a Russian cosmonaut who accompanies Sean Probst on the Ymir mission to capture an icy comet. Solid and stoic, Vyacheslav dies of radiation exposure with Sean and the others, but is a hero for his role in grabbing the humanity-saving comet.

Jiro Suzuki

Jiro Suzuki is a nuclear engineer on Sean Probst's Ymir mission, and a technical genius. When the nuclear drive in the comet malfunctions, Jiro must repair it and is exposed to lethal radiation. His death ensures the comet will make it close enough to the Cloud Ark to be retrieved by the New Caird.

Lieutenant Colonel Fyodor Antonovich Panteleimon

Lieutenant Colonel Fyodor Antonovich Panteleimon is the head of Soviet space operations on the International Space Station, both before and after the moon's fragmentation.



Symbols and Symbolism

The Moon

A symbol of fierce power and mythically charged, the Moon literally and metaphorically looms over *Seveneves*. Whether the reader is aware of lunar associations with the subconscious, female divine, the occult, and lunacy, doesn't matter. These are, as noted by the great psychologist Carl Jung, indelible aspects of the human collective unconscious.

In Neal Stephenson's *Seveneves*, whether intentionally or not, the Moon symbolizes both the dark feminine and the occult (in its original definition as hidden, or concealed). Out-of-control Earth technology is at once fragmenting, commodifying, and—through war and terrorism—killing humanity. When the unknown Agent strikes the Moon, humankind's secrets and historical patriarchy are shattered. The dark (in this sense, suppressed and hidden) feminine is released in the form of those women who will become the Seven Eves.

Fire

Another symbol with mythical resonance, fire is employed brilliantly by the author. Super-heated bolides smash the Earth and boil away oceans, as if blazing spermatozoa fertilizing the egg of rebirth. There is much to gain if the reader knows the Prometheus myth, with its warnings against stealing fire from gods and obvious projection onto thundering rocket engines hurtling fragile men and women into outer space's hostile realm. In the novel fire is both destroyer and purifier.

Water

Sacred and profane, water symbolizes life and waste (in *Seveneves* waste is used to sustain life, closing the loop), and is as vital to humankind in space as air and food. Water, by way of captured comet "Greg's Skeleton," even is transformed into rocket propellant. Old Earth becomes New Earth after Spacers bombard the surface with icy water- and nutrient-rich comets to create seas and breathable atmosphere. In the novel, water is to Earth what blood is to humans: life.

Earth

In dying, the planet itself symbolizes death of the mother, the nurturer, which necessitates either flying or falling from the nest. But the author complicates this by having Diggers and Pingers, intelligent, rugged humans who tunnel underground or dive down into ocean trenches for good or ill, giving the reader two more Earth symbols: cradle and grave.



Womb

The importance of this symbol in *Seveneves*, for obvious reasons, cannot be overstated. The International Space Station ("Izzy"), hub and base for the Cloud Ark and Swarm (surrounding arklets) symbolizes the womb from which humankind—like all newborns—will emerge and encounter the wonders and horrors of outer space. The Seven Eves—Ivy, Dinah, Tekla, Moira, Julia, Aïda, Camila—are the very wombs which nurture and give birth to a new, and wonderfully strange, humanity.

The Purpose

The late-mentioned Purpose symbolizes, for a post-religion New Earth deeply suspicious of dogma and nonsense, a free-floating mystical aspect haunting the secular, aggressively scientific culture. Everyone hears about it, yet the Purpose remains inscrutable. It is compared to faith, with those believing in, or at least open to, the Purpose seeming to lead happier lives than those locked into rigid logic and pessimism.

Interstellar Space

Space symbolizes, as it does in most speculative/science fiction, the unknown; everything "outside" humankind, and nonspecific otherness. Even without metaphysical and religious notions space possesses these qualities, and functions almost as if a macrocosmic Rorschach test upon which we project dreams, desires, terror, and beauty. While all these aspects are present in the novel, space is mostly represented as cold, deadly, and utterly indifferent to the life occupying it.

Hand Greetings/Salute

5,000 years after the Seven Eves landed *Endurance* on moon fragment Cleft, Survey and Snake Eater workers greet each other with hand gestures based on those used by the Seven Eves, and endlessly watched on videos which make up the *Epic* (chronicles of Old Earth). One of these is a sort of salute, which mimics the hand sweeping from the eyes the visor on a NASA space helmet.

Engagement Ring Photo

Perhaps the most powerful, and sad, symbol in the novel is nuclear submarine commander Cal Blankenship's goodbye to space-bound fiancée Ivy Xiao. During *Hard Rain* (destruction of Earth's surface by trillions of bolides), Cal uses a cell phone to photograph through his engagement ring the sub's open round hatch framing a burning sky. A symbol of undying love from a man on a dying world.

The Cloud Ark Swarm

This is a symbol of humankind's collective consciousness externalized, and transcendence of the flesh into a potential post-human future seeding the stars.



Settings

Earth (circa 2015)

Sevенеves' opening chapters are set on present-day Earth; before, during, and after the so-called Agent disintegrates the Moon. The reader is introduced to Dr. Dubois, Rufus MacQuarie, President Flaherty, Tavistock Prowse, Moira Crewe, and others whose lives are forever altered by the cosmic disaster.

International Space Station (ISS; aka "Izzy")

Izzy is the Hub of the Cloud Ark Swarm project to preserve humankind after the destruction of Earth's surface by super-heated lunar debris. The ISS is a real-world place, and author Stephenson chronicles its ever-expanding properties by a global collective of engineers, astronauts, cosmonauts, taikonauts, space workers and bureaucrats, in astonishing detail. The ISS evolves into the Cloud Ark Swarm and, after merging with an icy comet, Endurance, which ultimately reaches Cleft, a Grand Canyon-like region in a large moon remnant. It is here that the Seven Eves begin the work that sustains humankind for 5,000 years and eventual return to a terraformed Earth.

Cleft

The Cleft is a Grand Canyon-like groove in what was once the moon's iron core, exposed after collision with the Agent. The Cloud Ark—rechristened as Endurance—lands here, is permanently fixed to the metallic surface, and becomes a literal cradle for the Seven Eves' genesis of humankind's next generation.

Earth (circa 5,000 A.D.)

Five thousand years after the Moon's fragmentation by the mysterious Agent, humankind has survived against ludicrously impossible odds to begin life on the recovered surface. Through centuries of environmental manipulation (terraforming) by precise bombardment of icy comets to replace oceans and lakes, followed by reseeded of plants and animals, humankind is able to return home to a world both familiar and alien.

The Habitat Ring (circa A+5000 Years)

Orbiting a New Earth, the habitat ring is the largest construction in human history. Like a clock's dial with a ringed city 50 kilometers in diameter, the habitat holds three billion persons of seven races descended from the Eves. The Eye of this ring has one end tethered to Earth, the other reaching into space and anchored to a counterweight, which

allows it to encompass each of 10,000 separate habitats. Situated over the equator, the habitat must make constant adjustments in order to avoid entering the atmosphere.

Themes and Motifs

Survival

Author Neal Stephenson might very well have titled the novel *Survival*. From the opening scenes of the Moon's destruction; to Ty, Einstein, and the Pinger Deep sharing a meal 5,000 years in the future, survival clicks like a black clock. The characters present in the story's first years, though, virtually have no awareness of the future, as each moment must be planned and carefully enacted by whichever "shift" happens to be in progress while others sleep and attempt to recover from the rigors of their own labor. The Spacers don't represent survival—they are survival.

Numerous scenes depict characters improvising devices and methods to aid survival, some of which carry over into real life. Papers could be written on this element alone, especially about survival in space, where the smallest error can result in catastrophe. Few other genres can claim to explore existence at such close and perilous range as so-called Hard Science Fiction.

The most prominent symbol that represents the theme of survival is the establishment of the Cloud Ark around the current ISS station. This project is developed in part to give hope for the propagation and preservation of the human species—ultimately its survival. Likewise, the main protagonists in the first two parts of the novel each reflect the theme of survival, from the Earthbound inhabitants such as Rufus MacQuarie and Cal Blankenship (who survive against all odds by finding refuge from Hard Rain underground and under the oceans) to the inhabitants of the ISS, including Ivy Xiao, Dinah MacQuarie, and Tekla Alekseyevna Ilyushina, among others. Ultimately, the protagonists in *Seveneves* are forced to explore in order to survive.

The survival theme is also an archetype embedded in human consciousness—the oldest besides the sex-drive. In *Seveneves* the reader witnesses the evolution of the survival trait in various characters, some of whom take it to the terminal point of death to ensure others might live. And indeed, connected to the theme of survival is the theme of sacrifice. When the Seven Eves and final remnants of Old Earth land in the Cleft (a Grand Canyon-like feature in the Moon's exposed core of iron), a program of selective breeding through genetic manipulation is activated to delete "undesirable" qualities in the next generation. In any other context, this might be viewed as extremely controversial, akin to early 20th-century eugenics projects conceived by the United Kingdom and conducted not only by the Nazis but America and other countries. But the Seven Eves meet and, under Dinah's threat to detonate an explosive device if the group can't come to consensus, render moot any potential for "negative" effect.

No other trait or desire can equal the tremendous charge present in the will to survive. This accounts for the human ability to conceive, design, build, and pilot dangerous devices into space with personal safety—however temporarily—a minor concern. Some transpersonal philosophers see this as the will to become, or overthrow, God. Less



grandiose speculations (particularly in the published works of Swiss psychologist and psychiatrist Carl Gustav Jung, 1875-1961) cite the bird as a symbol of transcendence, its modern equivalent manifested in high-performance jet aircraft and rockets designed to escape mundane Earth. In *Seveneves*, however, such energized symbols are completely absorbed by constant stress and risk management.

The actions of former U.S. President Julia Bliss Flaherty represent another aspect of survival: that of self preservation. While many characters in the novel sacrifice their lives in order to preserve humanity's future, Julia's actions endanger others and put the entire Cloud Ark mission at risk of disaster. As the narrative progresses, Julia's actions further endanger humanity while she attempts to save herself.

The theme of survival is also illustrated through the many Biblical allusions interspersed through the narrative of *Seveneves*. Many of these allusions refer to the Biblical flood, as the "Ark" is named for, and the "Hard Rain" and "White Sky" also reference. The setting of Moses Lake, another Biblical allusion, stands as another symbol reflecting the theme of survival. Here, the nomads who occupy the facility at are referred to as "Space Okies," indicating that they, like the Okies who migrated west during the Dust Bowl, are desperate to hold onto some hope for a future—and to find a way to survive.

In Part 3 of the novel, it is apparent that the protagonists from the first two parts have achieved their goal of survival and preservation. Through the Seven Eves, humanity has been propagated and life on Earth has begun to reemerge. Moreover, two races of humans have managed to survive underground (the Diggers) and beneath the oceans (the Pingers). The question at the end of the novel is whether these different groups can maintain peace in order to sustain survival in the future.

Exploration

Exploration becomes necessity in *Seveneves* and relates directly to the theme of survival, as pre-existing space programs are forced into hyperactivity. These, some languishing from apathy and under-funding, are joined by those of space entrepreneurs first perceived as manipulative and cynical. But (as with Sean Probst's tragic heroics) these perceptions are soon overcome by sheer force of effort driven by frenzied innovation and engineering demanded by the situation.

The theme resonates through time even to decades before the Moon disaster, when speculation and research into the possibilities of asteroid- and comet-mining began. Had this never happened, the whole of humanity portrayed in the book would not have survived its catastrophic events. Exploration is deeply joined to survival, and is a primary trait of humankind.

Several examples of symbolism connect to the theme of exploration in the novel. The first of these is the setting of the ISS itself, which stands as a beacon of hope for doomed mankind. In order to achieve the mission of expanding this setting so that it can



house 1,500 more residents, the crews working on the ISS must explore and determine what resources can be mined and executed.

Dinah MacQuarie plays a large role in this endeavor, honing her robots and altering them in order to assist her boss, Sean Probst, in mining water from the comet Greg's Skeleton. Like the ISS, Greg's Skeleton stands as a symbol of exploration and of survival in *Seveneves*.

A poignant (even ironic) scene has people in a space habitat gathered around the first camp-fire in 5,000 years, like Neanderthals capable of space-flight. It is here, thanks to author Stephenson's skill, the reader realizes that fear is a vital aspect of sentient life, and drives progress on all levels from individual to collective.

Ultimately, exploration becomes a permanent element of life on New Earth, and in space. Once humanity knows what it can survive—and has survived—Earth will become a platform to launch still deeper exploration into hostile space. These notions are laden with melancholy and grief, as those with awareness of the deep past know certain traits (conflict, even a sort of racism) are indelible, perhaps accounting for the cyclical nature of all civilizations.

Apocalypse

The most visible theme in *Seveneves* clearly is apocalypse. Popular culture has altered the original Greek definition of the word from meaning revelation to mean to uncover. Now the term is associated only with mass destruction. Stephenson knows this, and wisely marries old and "new" definitions.

The theme of the apocalypse is symbolically represented in the first lines of the narrative through the author's imagery of the moon and its fragmentation. The moon can be seen to represent femininity, reproduction, mystery, and the subconscious. In *Seveneves*, the loss of the moon foretells the doom of Earth and its inhabitants. It can therefore be derived that without balance of the feminine and masculine, of logic and emotion, that humanity faces certain doom. As the novel progresses and more and more conflicts arise between the surviving factions, this symbolism proves true.

The sight in the sky, day and night, of the eerily spreading cloud of lunar debris spawns nightmares and dreams, and even Dr. Dubois—after an early fascination blooms into desperate hope that the moon's gravity will hold the mass together—cannot bear to look at it. The glowing smash becomes a harbinger of apocalypse.

As with other themes in *Seveneves*, the author likewise develops the theme of apocalypse through Biblical allusion. References are made to the Book of Revelations which foretells the end of the earth, and which likewise holds great symbolism in the imagery of the moon. The Hard Rain and White Sky that lead to the end of life on Earth are reminiscent to the Great Flood in the Bible, and the Seven Eves represent the life after apocalypse, and thus, a new beginning.



The theme is also manifested with terrible force on the individual level, with some adopting behaviors that keep them in constant distracted motion, while others bow to the inevitable and commit suicide. Worse, world governments, who don't actually have faith in the Cloud Ark but lie to the public about its vitality and promise, supply free euthanasia pills. Akin to attitudes in popular culture, everything—even death—is trivialized, and becomes another commodity geared to convenience and buffering of reality.

Apocalypse, in the revelatory sense of "uncovering," comes to pass when the Spacers discover Diggers and Pingers, underground and undersea survivors of Old Earth related to Rufus MacQuarie (Dinah's father) and Cal Blankenship (Ivy's fiancé). Whether the author's naming the character—Einstein—who leads far-future humans to the Diggers is symbolic, or even satiric, must be determined by the reader.

Rebirth

The theme of rebirth is ironically subtle in *Seveneves*, given its main premise of humankind's brutal struggle to survive in orbit for 5,000 years. This subtlety is a result of the narrative's unsentimental voice, which effectively matches those of the characters. Nonetheless, the theme is present, but remains one of many subtexts overshadowed by immediate concerns through the novel's first two parts. Only when the Seven Eves and a few others touch down on lunar fragment (once the Moon's iron core) The Cleft, does rebirth become an overt topic.

Rebirth is indelibly an aspect of apocalyptic fiction, but not always immediately apparent to the characters. After the Agent strikes the Moon, the common reaction (in various guises) is: How will this affect me? What can I do about it? How long have I got?

Initially, the human race wants only to survive. Some do not believe the dire predictions of science, until the Bolide Fragmentation Rate escalates and falling lunar debris begins claiming lives. Once those stuck on Earth realize they have only two years to live, the rebirth theme becomes more evident as personal despair is (by some) transcended, becoming a fierce drive to preserve the human legacy. Sadly, fearing rioting and mass panic, international leaders paint the future with bright colors, but a few (more humane) media types reject this and publicly state the grim facts.

Seveneves has humanity reborn three times: as space-travelers; genuine (because born in orbit) extraterrestrials; and—after much genetic manipulation once permanently established on Cleft—as hybrid inheritors of the New Earth.

As with the other themes that predominate *Seveneves*, the author supports the theme of rebirth through character, setting, imagery, symbolism, and Biblical allusion. As with the Biblical Flood, life persists in the narrative. The sacrifices made by characters like Markus Leuker and Sean Probst ensure humanity's survival, and essentially, its rebirth.

In Part 3 of the novel, which takes place 5,000 years in the future, humanity has achieved rebirth. And also symbolically, the survivors who have maintained life on the



planet—the Diggers and Pingers—emerge from underground and under water, imagery that reflects rebirth in the Bible and in mythology. Like the mythical phoenix, mankind has literally risen from the ashes of a planet that has sustained unimaginable destruction.

Collectivism

The theme of collectivism, in the sociopolitical sense, doesn't intensify until after Hard Rain, when the Earth's surface is both pummeled and super-heated by falling lunar debris. Cloud Ark commander Markus Leuker declares the equivalent of martial law, and the former International Space Station becomes a technical oligarchy.

After a while, the Ark population begins a sort of Cold War between those following authority (Blues), and those rebelling who want to break away and colonize Mars (Reds). Symbolism reiterating the theme of collectivism includes the electronic surveillance between both factions, with the Reds employing hackers to install listening devices in the Ark's Banana, or meeting place.

Early on, violence is limited to verbal outbursts and sarcastic blogging. Similar to behavior one can observe in real-world Internet culture, comments from both sides accrete around popular—or purposefully inflammatory—bloggers, and form topical collectives. In the claustrophobic isolation of arklets, this effect is amplified.

When the Reds, most of whose decisions are based on emotions, actually horde supplies and flee in an Modular Improvised Vehicle, their isolation breeds irrational beliefs and cult mentality which escalates into torture, murder, and even cannibalism (labeled by the politically correct among them as "hard" and "soft" cannibalism). This element above all illustrates the danger—when turned inward—latent in some belief-based collectives, without author Stephenson lapsing into outright satire.

The Reds contact the Blues, and request a rendezvous with Endurance, the vessel carrying the Seven Eves to Cleft and safety. The Blues (Ivy, Dinah, Moira, soon-to-perish Doc Dubois and Zeke Peterson, and a few others), seeing themselves as (reluctant) responsible types agree. The Reds dock with Endurance and launch an attack during which all but one—future Eve, Aïda—is killed. The lesson here appears to be this: civilization needs its Reds and Blues, but extremists on both sides upset the balance because they are painting with only one color, each accusing the other of selfish interest.

This theme carries into Part 3 of the novel as the seven “races” of descendents from the Seven Eves explore Earth and encounter two more races: the Diggers and Pingers. Upon discovery of the different groups, conflicts immediately emerge and threaten civilization. The reader is left to wonder in the end of the novel whether these different races will manage to work together, or will ultimately destroy one another.

Styles

Point of View

While *Seveneves* (whose title is a palindrome, befitting the book's circular narrative) is written in third-person omniscient POV, its perspective is as ever-shifting as the uncertain hour-to-hour—occasionally moment-to-moment—existence of the characters. Science-Fiction readers will have an easier reading experience than will general readers, but Stephenson's hyper-visual eye manages to be both insightful and cuttngly entertaining.

The author's employing conventional past-tense (as opposed to the "edgy" present-tense of much recent speculative fiction) narrative anchors an already dangerously overloaded storytelling vessel. Perspectives jump from an asteroid-mining robot's live video-feed to a dying astronaut's battle against a misdirected thruster, to the Cloud Ark crew witnessing both while forced to maintain technical control. Unusual viewpoints are frequent: stars flaring beyond a dime-sized hull puncture seen by a character frantically searching for something to plug the hole. Champagne jetting from a christening bottle in the hard vacuum of space. A dazzling kilometer-long bolide smashing through a forest and vaporizing a city. A nuclear submarine commander's goodbye to his once-future wife: the fiery sky through an open hatch, captured in a cell-phone image framed by his engagement ring.

Contrasting these more dramatic scenes are clinical POVs of scientists and engineers under constant stress, improvising devices and methods, some of which fail. *Seveneves* vividly portrays to a palpable degree the fragility of the body against the myriad hazards of space flight and its utterly hostile environment.

Language and Meaning

Stephenson's crackling prose, with its muscular verbs and nouns free of much adornment, sustains an ever-escalating tension fed by that of characters either earthbound and doomed, or imprisoned in space where death might come (via micrometeorites) literally in the blink of an eye.

The language is a quirky hash of ordinary words, inventions of new social media evolved in space, field-specific technical jargon, kit-bashed English, Russian, Chinese, and the later additions and mutations 5,000 years hence. The author's skill and precision at sentence-level writing and non-intrusive context renders the mix comprehensible to any fairly sophisticated reader. This occasionally jarring style is less-employed in the novel's third section set in the far future, when much of the evolved technology has been embedded into practically everything and is deployed by touch, voice, and thought, thus focusing more closely on characterization.



As in present-day study of ancient cultures, those 5,000 years into Seveneves' future must rely on found artifacts. For the Spacers, this is the Epic, a digital chronicle of Old Earth from before the Agent shattered the moon, to Cleft and some time beyond the first new generations. Not only does this device provide endless moments for New Earth residents to ponder, but adds to the reader's perspective. Throughout the novel and necessarily, new words and phrases are coined, and the author's contextual weave invests them with meaning.

Structure

Seveneves' epic length would be a much more challenging read had Stephenson not given it a traditional three-part structure and epilogue. The story itself is composed of three parts: the Moon's mysterious destruction; the exodus of selected (and rogue) humans into the International Space Station followed by the ruin of Earth's surface; the journey to, and colonization of, Cleft. The simple linear structure of beginning, middle, and end is satisfying in a story so densely packed with wonder and horror.

The early chapters are marked by frequent dialogue between earthbound characters and those aboard the ISS, media coverage following the moon disaster, and various descriptions of the debris cloud as seen in both night and day. Cliffhangers ending each chapter actually are natural to the story, as emotions rise along with political panic.

After official announcements to the world of the grim situation, the structure branches to include individual and collective reactions. Even the ISS crew are not given the "true" story, which emerges through slips and leaks that complicate the three-part structure, but only in a useful manner akin to forcing bulbs in a small pot: the constriction benefits the dynamic of the whole. The narrative divisions hover like historical milestones which, by virtue of the story, they are.



Quotes

His name was forgotten. By the time he had gotten his phone out of his pocket, his crater no longer existed. Nor did the moon.

-- Narrator (1: The Age of the One Moon paragraph 3)

Importance: A Utah amateur astronomer observes a dusty patch near the moon's equator, and believes he has witnessed a meteor-strike. His first thought is to capture the moment by blogging about it. This quote displays how deeply Internet culture has absorbed civilization, where real-time events are filtered by technology and only secondarily by thought and emotion.

...one of them could zip through space invisibly and punch all the way through a planet and out the other side. There used to be a theory that the Tunguska event was caused by one, but it's been disproved.

-- Konrad Barth, German astronomer (2: The Seven Sisters paragraph 40)

Importance: Barth—a brilliant astronomer—theorizes a "primordial singularity" (small black hole) might have caused the moon's disintegration. His mentioning of the 1908 Tunguska explosion, where roughly 800 square miles of forest were devastated by the equivalent force of 185 Hiroshima A-bombs, emphasizes both the scale of the moon event, and its inexplicable cause. Scientists took over a century (2010) to reach consensus that Tunguska was struck by a 70-meter iron asteroid fragment.

None of you will ever stand on terra firma, touch your loved ones, or breathe the atmosphere of your mother planet again.

-- Julia Bliss Flaherty, U.S. President (3: Scouts paragraph 40)

Importance: Shortly after the Agent (scientists' name for the moon's unknown destroyer) strikes, the President addresses the 12 men and women working in the International Space Station, and delivers this stark, unsentimental message. This scene's importance lies in its revealing President Flaherty's essential character with chilling precision. She's more than the strong, competent woman-type frequently encountered in contemporary science fiction.

The idea Sean was playing with here was so monstrous in a way that it was almost inconceivable: that everything they were doing up here was a lullaby for the seven billion down below. That it could not actually work. That they were just putting on a show of getting ready. That the people of the Cloud Ark would live only a few weeks longer than the ones left behind.

-- Narrator (4: Pioneers and Prospectors paragraph 164)

Importance: Billionaire space entrepreneur Sean Probst violates policy and has his company launch him on a one-way mission to the International Space Station. He informs the crew that the entire Cloud Ark project to preserve humankind cannot—as currently designed—possibly succeed without an immense supply of water from which



to produce propellant. Individually, the crew have assumed earthbound authorities will quickly solve this problem. The quote captures their collective realization, and dread.

All the people saying mean things about me on the Internet are gonna be dead in four hundred and thirty-three days.

-- Ivy Xiao, original commander of International Space Station (5: Consolidation paragraph 132)

Importance: As Earth's imminent end approaches, the Arkers' ever-present anxiety worsens. To cope, many indulge in desperate, dark humor; some of it bitter. Author Stephenson shows a grim truth: the worse a given situation (war, natural disasters, etc.), the darker the "jokes."

[...] They'll look after the stuff and bring it all back here to the chopper so you can keep your hands free for making those little bows and shaking hands with the king or whatever. As soon as we get back to the aircraft carrier, we'll throw it overboard.

-- Mario (no surname given), a New York photographer (6: Casting of Lots paragraph 40)

Importance: In Bhutan, where Dr. "Doob" Harris is asking what to expect during a local farewell ceremony for a boy and girl in their early twenties selected to become Arkers, Mario—who's seen too many of these "abductions"—expresses angry cynicism about the dishonest process (bestowing of precious cultural artifacts for preservation in space), and how it's designed to put a bright spin on reality.

PCA was an abbreviation for 'present circumstances aside' and had become a staple of Facebook, Twitter, and the like.

-- Narrator (7: Cloud Ark paragraph 24)

Importance: Another pointed example of social media's adaptability, which rings authentic.

Looking down at you now,' Doob texted. He wanted to add 'Wish I was there' but it would have been stupid. 'Looks like a big one coming in over southern BC.

-- Dr. "Doob" Harris (8: White Sky paragraph 15)

Importance: Very shortly before "white sky" becomes "hard rain," Dr. Harris peers down from the ISS to watch streaking meteors and bolides. Due to extreme bandwidth traffic, he has been able only sporadically to communicate with his wife and sons. In this scene, he manages to text his son Henry, who is watching from Moses Lake, Washington, ever-increasing debris heating the atmosphere. This could be the last time father and son "speak," but Harris is pulled away by duty.

We have a module full of freeze-dried dead people,' Markus reminded her, 'that we need to jettison anyway. And I would be happy to jettison it in the direction of any straggler that is threatening the Cloud Ark.

-- Markus Leuker (9: Hard Rain paragraph 69)



Importance: A few heavy-lift rockets, here referred to as stragglers, manage to lift off in spite of the danger posed by the fiery storm of debris. Most are unsanctioned, and therefore a threat to ISS safety. The only recourse—defense-wise—is to eject physical objects. Given the speed of incoming vehicles, literally anything will puncture a hull. A number of people died either on the way to the ISS, or from construction accidents, and had to be frozen in the morgue. Markus takes practicality to a new level.

...she had woken up in the White House next to her late husband and gone down to breakfast with her late daughter, straight through to the end of the world, and her hastily arranged launch into orbit, some thirty-six hours later.

-- Narrator (10: Ymir paragraph 8)

Importance: Julia Bliss Flaherty, U.S. president, arrives illegally with a literal crash. The quote details her priorities during her final day on Earth, and foreshadows those to follow.

Suicide took about one in ten over the course of the three-year journey.

-- Narrator (11: Endurance paragraph 20)

Importance: After Endurance (formerly the ISS) is fitted with the immense ice "splinter" captured by tragically heroic Sean Probst and his crew, the new mass burdens the projected 1-year, 300,000-mile journey to Cleft into 3 years. The quote sums the net human cost. Some commit suicide for traditional reasons; others due to radiation sickness and cancer (real hazards in long-duration space missions) and not wanting to overtax dwindling food and water supplies. Another instance of author Stephenson staying true to scientific realism.

There is a process known as parthenogenesis, literally virgin birth, by which a uniparental embryo can be created out of a normal egg. It's been done with animals. The only reason no one ever did it with humans is because it seemed ethically dodgy...

-- Moira Crewe (12: Cleft paragraph 54)

Importance: Only 9 people survive the 3-year journey to Cleft, and Dr. "Doob" Harris dies after a final "moon-walk." The surviving 8 are all women, and hold a meeting—the Council of the Seven Eves—to decide whether to continue existing. Seven, due to Luisa's having passed menopause. To ensure everyone votes, Dinah has gone outside and attached a powerful explosive to the viewport—set for demolition in 10 minutes.

The canids are going epi in a huge way. They've become nearly unrecognizable.

-- Rhys Alaskov (13: Five Thousand Years Later paragraph 97)

Importance: Reacting to material in Old Earth scientific journals regarding "epigenetics," the GID (Get It Done) school of thought in the Fifth Millennium desires to seed New Earth over centuries, rather than the conservative TOT (Take Our Time) "handcrafted" method that would require much longer. Canids are mammals similar to a



dog, wolf, or coyote, and Alaskov observes that letting them breed without DNA tampering has produced interesting hybrids.

Each enhancement is an amputation.

-- Narrator (13: Five Thousand Years Later paragraph 145)

Importance: An aphorism coined by the Blue (followers of Endurance traditions) faction, used in a prejudicial sense toward new technologies. Compared to pre-Zero (period before the Agent disintegrated the moon) America's Amish people.

Makes me wonder,' Kath Two said, 'if some previous surveyor saw what I saw, and triggered a wave of missions in the same area.

-- Kath Two (13: Five Thousand Years Later paragraph 168)

Importance: This is the first instance where the reader might suspect that survivors of Hard Rain exist on Earth. Kath Two had noticed lots of activity in the area she was tasked with surveying, and takes this as a search for Sooners—orbital habitat dwellers making illegal visits to the surface.

...what Cal was hinting at, with these photos, is that there was another program...that we never heard about.

-- Esa Arjun (Epilogue paragraph 25)

Importance: Esa refers to 5,000-year-old selfies taken by Eve Ivy's fiancé, Cal, stationed on a nuclear submarine. He had positioned himself before a shelf of prominently labeled binders whose titles indicated the existence of a contingency program for deep-sea survival on par with that for the Cloud Ark—but classified, thus secret from the public.