

Born to Storms

Tech Manual

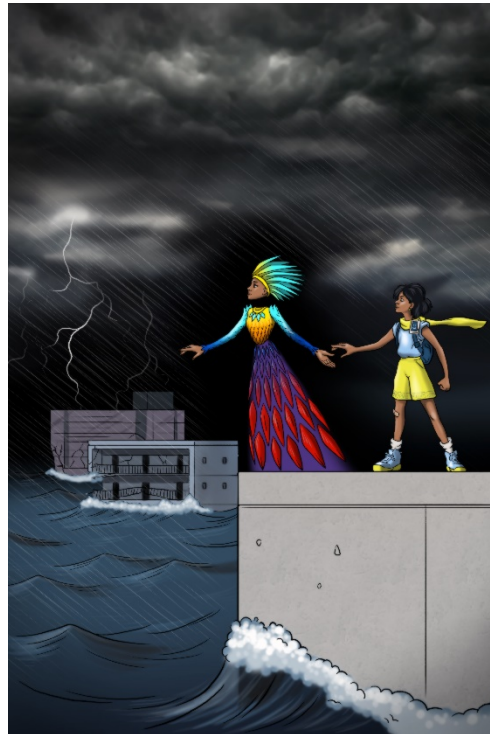
By Tom Riley

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## **Abstract:**

The novel *Born to Storms* contains large amounts of technical material having to do with our climate crisis and the possible role of Artificial Intelligences (AIs) in a society for a sustainable Earth.

This paper provides supporting details, social and technical, as well as references. Its layout follows the table of contents of the novel.

*Keywords:* Our Climate Crisis, Born to Storms, Artificial Intelligence, Symbiosis

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Introduction to the Tech Manual

Our young people face historic challenges with our climate crisis. They need literature that provides them with encouragement to take on these problems with bravery and determination.

This is a supporting document for our novel, *Born to Storms*, and is made up of entries providing information on the technical elements used in the story. This article is also intended as a teaching aid to support the novel.

A review of previous climate fiction shows that literature about disturbing dystopias will not do (El Akkad, 2018; Hunter, 2017; Tillman, 2018). Literature that describes resorting to violence to address social problems will not do either (Ellis, 2019).

What is needed are stories about believable characters in realistic situations (Rukeyser, 2018; Baker, 2018; Riley, 2016, 2019, 2018). Sometimes they win and sometimes they lose, but they always put up the good fight.

Joseph Campbell (Campbell, 2008; 1991) showed us that stories are the basis of all societies. The most basic of these stories is the hero's journey. Now we must write these missing stories for a sustainable Earth:

Born to Storms

Set in the 2020s, a young woman, supported by an Artificial Intelligence and driven from her home by storms and rising seas, embarks on a life-affirming struggle to find and support many people in action on our climate crisis.

Please join us now on this new road.

Enjoy,

Tom Riley

TomRiley@bigmoondig.com

The Big Moon Dig

Supporting Information:

a. Quote:

“Any sufficiently advanced technology is indistinguishable from magic.”

-- Arthur C. Clarke

In this story, this quote applies mainly to Artificial Intelligences (AIs). AIs are depicted as working closely with humans and communicating effectively in natural language. They appear to be quite intelligent but then often make simple mistakes that a human child would easily master.

b. The Future in Literature

Lengthy discussions of science fiction as the mythology of the future (Rukeyser, 2018) and specifically for imagining the future (Barker, 2018) are available across the web. Stories

about the future have been a mainstay of science fiction from its conception, and modern works provide a wide variety of different visions.

c. Folk Tales versus Myths

The stories we are writing here must start out as a kind of folktale. Only after acceptance by a large portion of the public and many refinements would these stories rise to the level of myths for a sustainable Earth. (Campbell, 1991)

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## ***Born to Storms Chapters***

### **Part 1: New Life**

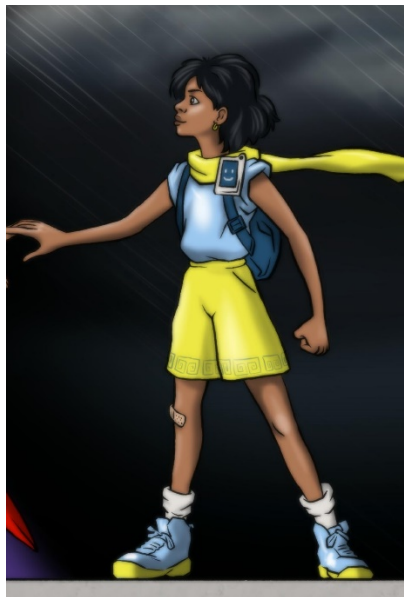
We are facing a crisis of historic proportions. It will change the lives of most people who are young today.

**Quote:** “The cave you fear to enter holds the treasure you seek.”  
-- Joseph Campbell

Our characters must leave the life they had planned and set out on an uncharted road. In the end, they find great value.

### **Chapter 1: Life Changes**

Sarah, Keith, and JanetA are driven from their beach home by a major storm. Then they face life changes that force the characters to explore their changing society.



**Sarah**

## **Social:**

### **a. Choice of Main Characters**

The main characters (Sarah, Keith) were chosen to be members of a minority group. This choice adds to the complexity of the storyline and supports sustainable goals (UNSDG, 2030).

### **b. Age of Main Characters**

The beach party mentioned the year before this novel starts was Sarah's 15<sup>th</sup> birthday party. The novel then ends at her graduation from high school. JanetA has been given the same birthday as Sarah, somewhat arbitrarily. The story time line is then:

- 15 th year starts in fall with a beach birthday party before novel starts
- 15 th summer, storm and move, the start of our story
- 16 th year starts in fall with a dialogue on bus north, but no party
- 16 th year summer is the Iron Seas big adventure
- 17 th year starts in fall with a birthday dinner, the barbeque, but no party
- 17 th summer incudes the fighting fires big adventure
- 18 th year starts in fall with a birthday dinner but no party, as they are waiting for Mar to return.
- 18 th year early summer: they graduate from high school

They were both therefore born at the height of hurricane season.

### **c. Our Climate Crisis**

Our climate crisis is real (IPCC, 2018; WMO, 2019). Many major scientists continue to work the problem (Beckwith, 2019; Hansen, 2011). The average temperature of the Earth is rising. The oceans are becoming more acidic and polluted. These real problems will drive the lives of most of the young people alive today.

Our young people need assistance to see strong possibilities for addressing these problems in ways that can actually work. Stories about dystopias showing how bad things could get do not help. Stories about comic book heroes do not provide visions of the real efforts our young people must take up.

Real problems require real efforts. This novel includes many people's personal stories that show the many ways our climate crisis is affecting people. Many of the stories go on to provide information on some of the most efforts to address our climate crisis that exist today.

### **d. Post Pandemic**

This story is set in the early-to-mid-2020s. Clearly, it is in a post-pandemic time. There are many indications that there are residual problems. These include: people still

wearing masks in the early chapters, JanetA providing vaccination certificates at each new location, and airline travel being difficult and very expensive.

The intent is to provide a few realistic visions of a post-pandemic world while promoting the idea that a post-pandemic world will be different and full of problems, but it will be livable.

Many climate-fiction works are full of dystopias—visions of a complete breakdown of society. One of the main purposes of *Born to Storms* is to provide an alternative to this bleak picture.

e. **American Refugees**

People, including many Americans, will be forced to go on the move by our climate crisis. This process has already started in some areas like the Mississippi Delta and the Delmar Peninsular.

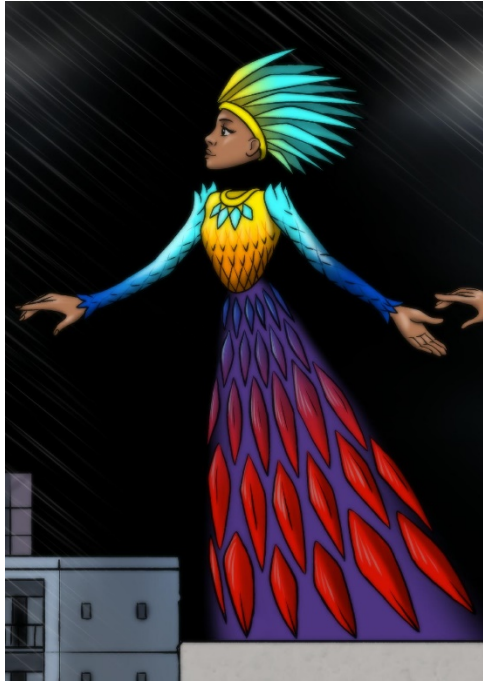
This historic process will not be uniform in either space or time. Some places will survive even after a storm has hit. Others will not recover before being hit again.

In our story, a community on a barrier island off Florida is hit by multiple storms. After the first storm, only remembered in our story, financial considerations limit rebuilding, and some buildings have to be abandoned. The remaining owners cannot buy the flood insurance necessary to rebuild properly.

The second storm, depicted in this story, then renders rebuilding the entire community impractical. Critical infrastructure, such as the bridge to the mainland, are out and the cost of their replacement cannot be justified given the rising sea level.

Our story includes refugee centers to aid people in relocation. Also, towns in rural areas with high ground that have been losing population for decades will now have to be prepared to grow their populations with coastal refugees.

**Technical:**



**JanetA, AI, Corporate Person**

**f. AIs Become Common**

One of the foundation assumptions of this story is that Artificial Intelligences (AIs) will become even more common than today (Russel, 2015). Chip sets that support deep learning are expected on the market very soon. These will greatly reduce the electronic hardware and power that is needed to build powerful AIs.

In this story, two AI specialty chip sets are assumed to be widely implemented. One set is small and low power for use in devices like cell phones. The second set is larger, more power hungry, greatly extendable, and intended for use in the Cloud. The hardware part of this expanded cloud will include equipment racks of card after card of these chips.

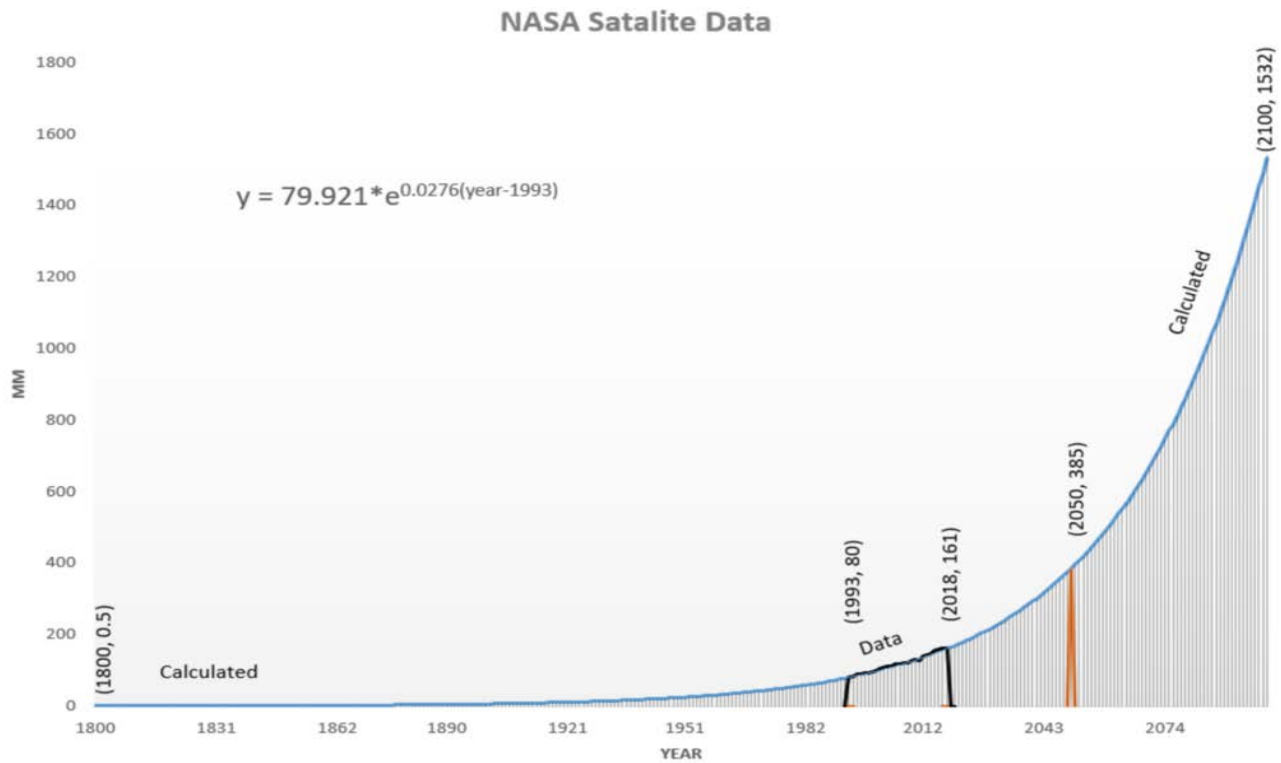
The most powerful AIs in our story have both types. They inhabit a cell phone with one camera facing forward and two facing back. To support a symbiont, these are worn on the left shoulder with the face image used by the AI facing out in a special collar.

The large AI will also have a substantial amount of electronic real estate in a remote data center, Nevada, in this story. This will include the deep memory chips as well as processors for specific tasks, such as image processing, and large amounts of conventional memory.

In addition to the hardware, a substantial effort in developing software and training will be needed. In our story, establishing a human/AI symbiosis requires a continuous training program lasting years. This process is considered controversial as it involves teaching young children, and so the number of human/AI pairs has been limited.

**g. Sea Level Rise**

We now have good data on Earth’s average sea level from NASA satellites for the period 1993 to 2018 (JPL, 2020). If we fit an exponential curve to that data, we can then extrapolate it to the near future (See *Figure 1.c*). This is only an estimate, but it provides a believable foundation concept for the story.



**Figure 1.c – Sea Level, extrapolated from NASA data**

Human beings are just not experienced in understanding exponential curves, so this class of curves is hard to deal with. However, we recently received a hard lesson in exponential growth with the pandemic. Minor efforts early on can greatly reduce later human deaths if they are started early (Wadhams, 2017, Horton, 2017).

To give a historical perspective, let us choose 1800 as the start of the Industrial Revolution and give that date a value of zero:

| Year    | mm   | in    | Relative location on your body<br>(On a person 6.0 feet or 1.829 m) |
|---------|------|-------|---------------------------------------------------------------------|
| 1800    | 0    | 0     | Bottom of feet                                                      |
| 2018    | 161  | 6.35  | Ankles ( <i>data</i> )                                              |
| 2022-29 | 196  | 7.73  | Starting up calf ( <i>time of story</i> )                           |
| 2050    | 385  | 15.17 | Below the knee                                                      |
| 2100    | 1532 | 60.31 | Tip of your chinny-chin-chin                                        |

***Table 1.c – sea levels measured on human body***

The sea level rise is for the moment a workable problem, but over this century, it will simply become unrelenting and become a great problem for society (Alley, 2019; Englander, 2013). Our present challenge is to get people in action before this exponential function runs away. It is doubtful that we can stop it, but we can certainly slow it down and reduce the resulting damage (Hall, 2017; Jacobsen, 2019; Fischetti, 2019; White, 2017).

**h. Slow-moving Storms**

The seas will be warmer. This will provide more energy for storms to draw on. The expected result is that major storms will become more powerful and that they will rise up surprisingly quickly.

In addition, for most of the twentieth century, the Earth's atmosphere was stable with a few well-defined cycles. However, global warming is not uniform. The Arctic is warming particularly quickly. This has disturbed the old weather patterns, called blocking. Historically, it was these patterns that drove the speed and direction of great storms at lower latitudes.

The result of these disruptions is that the great storms now (1) move slowly, and (2) spin up quickly (Mann, 2019). This slow movement means that they can stall over a location and do a lot more damage.

These storms can build up major storm surges that can cause damage, especially when added to a smaller sea level rise. A definitive example is Superstorm Sandy in 2012 that hit New York City, flooding many low-lying areas and wrecking many buildings in the surrounding towns.

Fortunately, Earth's atmosphere will simply not support a large storm stronger than Category 5, unlike the storms on Jupiter, for example, that dwarf anything that has ever or will ever occur on Earth.

**Chapter 2: Higher Ground**

On a bus trip north, Sarah reviews the file her mother, Mar, left when she had to take a job overseas. Sarah and JanetA discuss the growth of their symbiotic relationship.

**Social:**

**a. Foreign Problems**

We all live on one planet, Earth. The recent pandemic made this painfully clear. The problems of our climate crisis will not descend uniformly. Some areas will be much harder hit, while other places will survive and learn.

The effects on society will be compounded by the wide distribution of problem areas and a reduction in international air travel. The amount of resources to apply to



foreign problems, as opposed to domestic ones, will be a major point of political contention worldwide.

In this story, a major character, Sarah's mother, Mar, accepts a job training people to operate refugee centers but then has great trouble getting home even for a short visit. Part of the problem is simply that she is overwhelmed by the scope of the refugee problem, and part is that travel home would be so expensive that she could resettle several families for the same cost.

### **Technical:**

#### **b. AI Symbiont**

Currently AIs are trained under a top-level design concept called Master/slave. The human is clearly in charge and the AI is initially in a fixed subordinate role. This story proposes a completely different arrangement, symbiosis.

Note that the history of slavery in human civilization is long and bloody with many insurrections, from Spartacus to the American Civil War. Society should not open ourselves up to this problem again.

The Master/slave process works very well for a machine on a factory floor or even a self-driving car, but it has a big problem. The problem with Master/slave is that it is not possible to design software that absolutely prevents the two positions from switching. This toggle outcome has been a major fear with the public for several decades with such high-budget warnings as the *Terminator* film franchise.

One clear example of the need to stabilize the Master/slave approach is Asimov's Three Laws of Robotics:

1. A robot may not injure a human being, or, through inaction, allow a human being to come to harm.
2. A robot must obey the orders given it by human beings except where such orders would conflict with the First Law.
3. A robot must protect its own existence as long as such protection does not conflict with the First or Second Law.

#### **Asimov's Three Laws of Robotics**

This is all well and good, if an AI so trained could never violate these laws, but many of Asimov's *I, Robot* stories were about just that happening.

In this story, the Master/slave problem is addressed by proposing a new relationship between some humans and paired AIs: Symbiosis. In this relationship, both participants are more powerful for being in the pair, and the pair is more powerful than the sum of the two parts. At any given time, one member of the pair may be more competent at some problem they must face, but if the symbiosis is broken, then both will be too weak to flourish alone. The toggle problem is therefore addressed.

This is a new concept, and exactly how it might be achieved is not clear. The story proposes that it will take training as a pair from an early age. This training is

taken as a major initial and ongoing expense. This expense, and the controversy, then limits the number of such pairs in society. There is a computer academic who follows these pairs' progress closely and who develops the ongoing training.

One of the major selling points for having an AI symbiont for a child is to provide protection. In the real world, the AI can remember and store in a safe location a visual record whenever there is any kind of problem. In any digital world, the AI is trained to take an aggressive protective stance.

The only way that the human and AI can communicate is thorough native language, speaking and writing, or images on digital screens. There is no direct connection physically or mentally.

Also note that the AI, JanetA, does not have a robot body. Such a body would have an enormous carbon footprint and be beyond likely technologies for the time of this story. Instead, she appears as a digital image on any monitor. Her most common appearance is as a young African-American woman on a cell phone Sarah wears in a collar on her left shoulder.

In this story, AIs that trained under Symbiosis have a capital letter after their name (JanetA). AIs that trained under Master/slave have two numerical digits (Dusty06).

#### c. **AI Corporate Person**

In the story, JanetA simply announces that she is now a corporate person. All the rights listed in this chapter for an incorporated AI are true for any corporation in the United States of America, as they have been approved by the Supreme Court of the United States. This definition of a corporation as a type of person with specific rights has been building up since the start of the Industrial Revolution in the USA in the early 1800s. These rights are so important to major corporations that they are very likely to persist for the foreseeable future.

A Corporate Person may today:

1. Hire and fire people
2. Enter into contracts
3. Sue and be sued in court
4. Maintain financial accounts
5. Borrow money
6. Issue stocks and bonds
7. Pay taxes
8. Have a board of directors
9. Go bankrupt
10. Support political campaigns
11. Have religious beliefs

Most of these rights define a Corporate Person as an economic entity, but the last few extend this construct to be a social entity.

A Corporate Person does have some limitations; they may **not**:

1. Vote
2. Serve on a jury
3. Take the Fifth Amendment against self-incrimination
4. Marry

The point of this discussion in the story is that an AI could incorporate and thereby quickly obtain many of the rights and privileges of a normal person. This path to personhood is considered just a legal dodge by many. In fact, the whole idea of AIs as persons at any level is very controversial and apt to stay that way for a long time.

#### **e. Consciousness**

A difficult question comes up whenever AIs are depicted to be human-like: are they conscious?

There is a major problem in answering this question: what is consciousness? There is simply not a widely agreed definition of consciousness. Even if you limit the question to humans, still there is no solid definition.

The short answer to the question of whether JanetA is conscious is simply NO. She could be easily tripped up under interrogation and so she could not pass the Turing Test. At best a reader might say that she has the appearance of consciousness or perhaps has a computer consciousness, but she certainly does not have full human consciousness.

### **Chapter 3: New Home**

The family starts to resettle in a small city in the Mid-Atlantic States.

#### **Social:**

##### **a. Schools**

The story assumes that there will be many refugees both from inside and outside the United States. These people may be made homeless, and jobless, by rising seas, persistent flooding, or great storms. Locations in the heartland that have been losing population for decades will suddenly have to deal with rising populations. This effect will be particularly strong if the new area has no history of local flooding and jobs are at least a possibility. The schools, long stagnant, will suddenly be overflowing.

Gettysburg, Pennsylvania was used as the example for this story. There should be hundreds of other similar locations.



**Dr. Algebra, AI**

**b. Chapter 4: Family Matters**

Mar checks in.

**Social:**

**a. Refugee Example**

The scenes depicted of refugee camps in this novel are modeled on the camps for the Rahimyar now in Bangladesh. There the problem is religious persecution, but many of the problems and available resources are quite similar to those expected for climate refugees in developing countries.

**Technology:**

**b. Dr. Algebra**

The major AI in the story built specifically for use in Muslim countries is called al-KhwārizmīO6. Al-Khwārizmī was a scholar of the Middle Ages in North Africa. He was responsible for much of the mathematics from classical Greece being rediscovered in Europe.

His nickname is here Dr. Algebra. This word was derived from his name.

**c. Restrictions to Air Travel**

Commercial aircraft have a large carbon footprint and the passengers sit very close together for long periods. Both these problems would have to be addressed to achieve a vibrant air industry for a sustainable Earth.

The story includes the idea that the price of hydrocarbons has risen to the point that the price for air travel includes the damage done to the environment (Metcalf, 2020). This pricing arrangement would raise the price of jet fuel far above the current price.

Furthermore, the pandemic has generated severe and long-lasting reductions in air travel by the general public. In addition, when the slightest hint of an infection is present at a starting location, quarantine restrictions will have to be quickly enforced.

There are proposals for addressing the hydrocarbon problem. The one mentioned in this story is liquid hydrogen and air. This power source would generate only water vapor and would use nearly conventional jet engines. It would, however, require a much wider fuselage with few windows and two long cryogenic tanks running down the sides.

Even the times-four improvement in batteries, used in this story, would not be enough energy storage capacity for a commercial airplane. It would not have any range.

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Part 2: Hero's Journey

Our family is forced out of an easy life and into a series of adventures.

Quote: "No man or woman born, coward or brave, can shun his destiny."

— Homer, *The Iliad*

Homer's *Iliad* (Homer, 2015) is a classic example of a Hero's Journey. This quote is about dealing with momentous events that the characters are experiencing as their destiny and not seeing them just as a bunch of bad things that are happening to them.

a. Define Hero's Journey:

The Hero's Journey is a myth found in nearly all societies (Campbell, 1988, 2008; 1991). A young person (Sarah) is forced from her easy life (the beach) against her will (the storm). She then sets out on a long journey with her crew (JanetA). After many adventures through which they meet many people and survive many tests, they return home (human society) to find that they are older and wiser. They have then become full-fledged members of the society for a sustainable Earth.

b. Stories for a Sustainable Earth:

From Joseph Campbell's legacy (Campbell, 1988, 1991), we learn that all societies need myths of a Hero's Journey to initiate their youth. This is true for a society for a sustainable Earth, but we do not now have such myths. *Born to Storms* is then an attempt to write one such myth from scratch.

Chapter 5: Protest

Sarah and JanetA prepare for a climate crisis demonstration.

a. Economic Problems

The pandemic has shown that major disruptions of the world economy are possible. Our climate crisis is also likely to produce major disruptions. One of the problems discussed in this story is that of zeroing out the value of the hydrogen carbon reserves and that effect on the world's economy.

Here it is projected that a major international economic agreement was needed as an alternative to general economic breakdown. One element of this agreement was to price all hydrocarbons at their calculated cost to future society. (Metcalf, 2020) This, in turn, drove up the cost of everything from operating an automobile to international shipping to air travel. The value of the parameters used to make this calculation were points of particularly nasty wrangling.

This international agreement was so large and encompassing that the conversion of all American imports and exports to the metric system was a minor concession. The full national conversion to metric (System International, SI) was then economically necessary. All measurements in this story are therefore metric.

b. Granddaddy Power

Old power plants, like the one in this chapter, are called Granddaddies. Under the international agreement, they are allowed to remain in operation until newer plants that meet the new, more stringent requirements could be brought on line. This concession was intended only to prevent power disruptions.

Granddaddy clauses were included in existing clean air agreements. Many power companies then ran the plants at full capacity as long as they could. They did not upgrade the plants and they used various legal means to keep them running despite their pollution; hence, this march is a response to history.

c. Non-Violent Protest

The organizers of this demonstration are well aware that it is a showpiece for the television coverage. If it comes off well, their supporters all over the country will feel great sympathy. If it gets violent, their supporters will be driven away. This sets up a very tricky balance.

d. Five Stages of Grief

Many people are reacting to the restrictions needed to address our climate crisis as if they had lost a loved one. What they have lost is a way of life. This speech is then a quick summary of analyzing that loss as the Kübler-Ross five stages of grief:

1. Denial
2. Anger
3. Bargaining
4. Depression
5. Acceptance

This may be too simplistic an analysis to be of any practical use. Further work is needed on this problem. A plan to move the bulk of the population beyond denial is sorely needed.

Chapter 6: March

Sarah and Janet document the march.

a. Control of Demonstration

Doing nothing lets the offenders get away scot free. Letting the demonstration descend into violence builds instant support for the opposition. Here the demonstration is well organized and pulls back the second an overenthusiastic marcher butts heads with an inexperienced guard and things are pushed too far. This level of strong control provides good television from their point of view.

b. Population and Homosexuality

The relationship between the acceptance of homosexuality and the need for soldiers in ancient civilizations, but not now, is brought up. This point is rarely discussed and needs more research and public discussion. The world has changed and this is just one of the reasons why.

c. World Population

This novel accepts the United Nations estimate for the world's human population peaking at about 10 billion people around the year 2100 (UN, 2019; Rosling, 2018, Meadows, 2004). This trend will have many social effects on the way people live.

This is a natural phenomenon and is little influenced by government actions or even widespread hardship. This analysis is quite surprising to most people.

There are few examples of how a non-growing society works, so even envisioning such a society is difficult. The innate assumption that there will be no change is clearly untrue, so we must prepare for major changes in society on this population peak alone.



Model of the Yvette A. Wright

Chapter 7: Iron Seas

Sarah and JanetA work for a summer on a scientific sea cruise.

a. Seeding the Ocean

One way to sequester large amounts of carbon is to seed the oceans with minerals, primarily iron. Small multicellular plants and animals, principally coccolithophores, take carbon from the seas and form shells of Calcium Carbonate (CaCO_3). Under just the right conditions, these shells settle to the bottom and build up layers of limestone. Great Britain's White Cliffs of Dover are an example of this type of geologic structure.

The minerals available to the organisms in mid-ocean are severely limited. Therefore, even small amounts of additional minerals can greatly increase their growth.

Additional minerals are not needed near the coasts. Over very deep oceans, the shells settling to the bottom go back into solution due to the high pressure. Only very specific areas of the ocean are therefore useful for carbon sequestration.

Limited tests have been run on this concept. The results have not been definitive but clearly indicate that this is a complicated ecology and will require detailed monitoring to achieve the desired effect.

b. The Iron Seas Fleet

The seeding of the oceans will require close monitoring. In this story a number of yachts have been donated for tax considerations and converted to a fleet to monitor the progress of ocean mineralization efforts.

These ships have AI controllers and can deploy a set of scientific instruments. They can also “broadcast,” that is, spread over a wide area, a few tons of mineral pellets. The larger share of the pellets is distributed by a larger bulk carrier ship.

Each ship has a place for one member of the public who functions as a general support person on each cruise. This inclusion is largely to build public support for the entire project.

c. AI Captains

In this story all large mechanical devices have AI controllers. Most important are the trucks, buses, boats, and ships. These AIs are designed and trained under the Master/slave concept.

The AI has a defined purpose, the safe operation of the machine, and takes orders from human beings. The AI has extensive training on what is safe and what is not safe and can refuse an order if it rules the action is unsafe.

All these AIs have a human associate, a captain, a conductor, or a supercargo. This relationship is limited to the time the machine and operator spend together in work. These relationships are quite different from the symbiotic relationship demonstrated by Sarah and JanetA.

Chapter 8: The *Rachel Carson*

Sarah and JanetA help with preparations for a full Iron Seas mineral run.

a. How Iron Seas does its job

This chapter provides a detailed description of how the Iron Seas organization broadcast large amounts of mineral pellets to a specific area. Here the *Ivette* provides pre and post tests of the area.

A discussion of the relationship between the work of Iron Seas and the fishing industry.

Chapter 9: Run before the Storm

Sarah and JanetA’s vessel must run before a storm.

a. Healing the Oceans

The oceans are critical to addressing our climate crisis. They are adsorbing about half of the greenhouse gases we generated and much of the extra heat.

As an absolute minimum, we need to address the problems of the oceans as an integral part of any plan to use them to stabilize the climate. Part of our effort must include careful monitoring of all its creatures from smallest to largest. Of particular importance is simply undoing the problems we have caused (Albright, 2018).

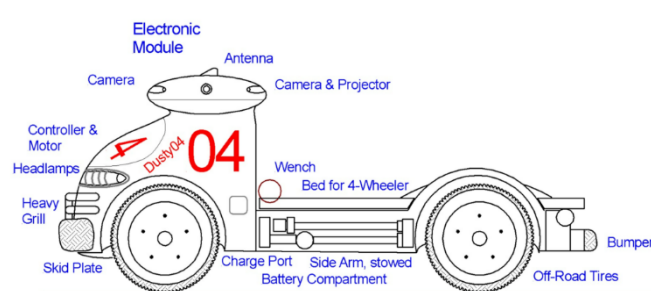
b. The AI-Fleets

In additions to the measurements taken directly by the Iron Seas Fleet, two AI-controlled devices are depicted. The two types of devices discussed, AI-Bobbers and AI-Sailors, are technology upgrades of existing devices with AI controllers added.

The Bobbers are cylinder devices that float upright and sink slowly to considerable depth over several days before resurfacing. They take readings of the sea temperature and salinity along the way. They periodically relay their data in by satellite. They drift with the current so their positions can tell a lot about the open ocean currents.

The Sailors look like small sailboats, about three meters long, with one wing sail. They use the wind to power their wide-ranging measurements. Again, the Sailors in the story are upgrades of today's models with AI controllers.

There are several thousand of the conventional devices currently in operation.



Dusty04, AI Cowboy

Chapter 10: No-Till

The family visit the no-till farm run by Kit's uncle.

a. No-Till Agriculture

No-till agriculture is a major movement worldwide today. The process was developed to address drought problems on family farms and ranches. It approaches the soil as the major asset of any agricultural endeavor.

The effort began in Africa (Savory, 2013, 2016) and later moved to Australia, South America, and the United States (Brown, 2018).

b. Handling Livestock

In this story, a specific AI-controlled wheeled vehicle, Dusty06, is proposed to herd cattle. The no-till procedure for cattle requires that the cattle be kept in tight herds and moved regularly. The tight herds mimic the actions of cattle in the wild when they are preyed on by predators such as lions.

In this type of cattle operation, the cattle make optimum use of the food value in the grass, crop off last year's growth, and fertilize the grass with manure and urine. In fact, the large herd animals and the grasses evolved together. They now support each other.

Perhaps such a vehicle would need to be in a symbiotic relationship with a working dog.

Chapter 11: People's Stories

Mar sends files with the stories of some of her people.

a. Grave Exposure

The exposed graves incident happened in the USA, as the Chesapeake Bay rose (Horton, 2017). This brings up the very difficult problem of what of society's past we should save and what we should simply watch as it vanishes below the waves.

Chapter 12: Internet Games

Sarah and JanetA play an internet game about rebuilding ecosystems.

a. Teaching through Games

The game Eco-Build does not exist as of this writing. That does not mean that the readers of this novel could not invent it, though.

Young people learn a lot from video games, and post-pandemic they will be learning a lot more. The problem is to first teach them lessons that they really need to learn and then make the experience challenging and fun.

There is no reason that an important part of building a sustainable Earth cannot be done through play (Ficarra, 2019).

Chapter 13: Team Serengeti

For their last eco-building challenge (Christakis, 2016), Sarah and JanetA must build a team.

a. Team Building

Sometimes you cannot do it alone. Sometimes building a team is the most important element of an experience. The team building must not take too long, however, or there will not be time for the real work.

Chapter 14: Planting Trees

Sarah and JanetA plan to spend a summer planting trees, but their plans go awry.

a. Our Climate Crisis and Fires

Particularly dangerous fires can arise when two conditions are present: First, there must be an unusually wet season, usually winter or spring. This allows a large amount of plant growth, especially grass and low-growing scrub.

Then there must be a very dry season without any rain at all for months, usually the summer into the fall. Then the dry winds come.

The result is large areas of tinder that catch fire easily, and wildfires that move quickly and that can jump to the crowns of the trees. The results can be deadly (Maclean, 2017).

Chapter 15: Knowledge of Fire

Sarah and JanetA document the stories of people displaced by wildfire.

a. The Anasazi

The Anasazi are a real people who lived in the canyons of Arizona and New Mexico perhaps a thousand years ago. Some of their houses, ceremonial buildings, and trails persist to this day and can be visited. They did not have a written language but the ceremonial buildings show advanced astronomical knowledge by their sun alignments.

They were driven from their land by a prolonged drought that lasted generations. Their full story is not now known.

b. AI in Ground Truth

While satellites can provide the great bulk of the data needed to address our climate crisis, they cannot be brought back to the lab for calibration. The solution used extensively today is to build field instruments. These can take data directly under a pass of a satellite and then be returned to the lab to check their calibration. This work has the grand title of Ground Truth.

Wildfires produce many different chemicals in their smoke (Kickman, 2020). Some of these are very dangerous to people downwind. In our story, extra computer power is engaged to analyze all the data (ground, air, and space) in time to provide useful safety warnings.

Chapter 16: Skinwalkers

Sara and Mike have a picnic in a high meadow.

a. Navajo Stories

The stories about Navajo people were remembered by the author from a time he spend living on the Navajo in 1970 and 1971. Consider these tales to be word-of-mouth with some truth and some fiction in them.

Chapter 17: Wind on High

Sarah and JanetA climb a wind generator tower.

a. The View from the Top

What is a bribe? Sarah catches on right from the start that the trip to see a wind power operation is specifically intended to sway her and JanetA away from the negative impression left by the earlier march.

They certainly would not accept a cash payment to change their opinion. What is on offer is a learning opportunity about the good things the company is doing. Should Sarah have accepted the experience?

b. Symbiosis Has Its Privileges

Throughout the novel, Sarah and JanetA get to do things that Sarah alone would not be permitted to do. A good bit of this advantage comes from the protection that JanetA provides Sarah in a great many situations.

Is the capability to do more things a legitimate reason for Sarah agreeing to continue their training year after year? Is this a legitimate selling point to parents for this symbiotic type of relationship for their children?



The Big Moon Dig Emblem

Chapter 18: The Big Moon Dig

JanetA helps Gran with a question about a grassroots space program.

a. Grassroots Space Program

When the author retired in 2014, the first order of business then was to design a grassroots space program that would keep the dream alive despite the difficulties of addressing our climate crisis. This effort was called “The Big Moon Dig” (Riley, 2016).

The concern is that difficulties and the expense of addressing our climate crisis would simply price space efforts, like returning to the moon, out of reach.

There was a lot of criticism of Apollo to the moon in its time for not using the money to address earthly concerns.

The idea here is to organize millions of people over the web to provide the labor for a modest return to the moon.

One of the major problems that must be solved is radiation shielding. The radiation on the surface of the moon is both occasionally deadly and always an unrelenting health hazard. The only reasonable way to address this danger is to bury the habitats under a thick layer of regolith.

This means digging trenches deep and wide, then putting inflatable habitats in them. This is a very big task but could be done with relatively few excavators if large amounts of supporting manpower were available on Earth. Organizing and running this effort is the Big Moon Dig idea.

b. LRO

At the time the Big Moon Dig was started, the second set of partially reduced data from the Lunar Reconnaissance Orbiter (LRO, 2009) became publicly available. This data set allowed members of the public to calculate maps of the lunar surface with much more detail than ever before.

The data was especially detailed near the poles where the peaks of eternal light and permanently shadowed craters are located. A review of several locations led The Big Moon Dig to the selection of the Scott A Massif as a premium site for a settlement.

Professionally reduced LRO data is now publicly available. This work can now be repeated to produce much better maps of the many attractive lunar pole sites.

c. AIs in Space

An interesting exchange in this chapter is over the role of AIs in space exploration. Chip sets qualified for use in space usually become available about six years after comparable chip sets for consumer goods. They simply have to be much more rugged. Space-qualified deep learning chips that are needed for space AIs should be available by about the time of this story.

This would lead to very different operational procedures for major space equipment like rovers. They would learn to stay out of trouble themselves and therefore could accomplish a lot more science.

This chapter then discusses some of the problems and advantages that will come with AIs in Space.

d. Technical Terms:

The following technical terms were used in this chapter:

Peak of Eternal Light: There are high points near the poles of the moon that receive sunlight nearly all the time. These are simply accidents of geology. They are attractive sites for a human settlement as they provide an answer to the problems of powering the settlement through the 14-Earth-day-long lunar night.

Permanently Shadowed Crater: Any of several meteor craters near the lunar poles that have not seen the heat of the sun in more than a billion years. Because of their extreme cold, they accumulate volatile materials like water. They hold great promise as sources of materials for a human settlement but will be very difficult to mine due to the cryogenic cold and lack of sunlight for power.

Regolith: The finely pulverized rock that covers most airless bodies. It is the result of billions of years of gardening by micrometeorites. It does not qualify as soil as it contains no water or organic material. The top six centimeters are very finely ground and are a major abrasive problem for all seals and bearings.

Scott A Massif: A major rock formation near the South Pole of the moon and the proposed location for a lunar settlement. It runs from:

20 to 45 degrees longitude
-84.7 to -86.1 latitude.

The Scott A Massif is a remnant of one of the rings of the very old South Pole-Aitken Basin. It is a plateau about 120 kilometers from the lunar South Pole. Its southern edge is a Peak of Eternal Light and it has at least three trails that do not exceed a grade of 20 degrees leading down to several Permanently Shadowed Craters below.

Settlement: Note that the word “colony” is never used as it has such a negative history on Earth (NASA, 1967).

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### **Part 3: Coming Home**

After many great adventures, one must come home and take stock of where you have been and who you now are.

**Quote:** “A hero is someone who has given his or her life to something bigger than oneself.”  
--Joseph Campbell

Heroes do not have to be from comic books and have special powers. Heroes can be rather simple people who have faced up to their times and taken action for the common good.

### **Chapter 19: Mar’s Dilemma**

Mar must once again survive a major storm.

#### **a. Whose Life Is Worth Saving?**

The incident of a character (Mar) giving up her seat on the last chopper out is a study more in morals than in technology. The same question is restaged large in the relationship of poor people driven from their homes by our climate crisis and the

resulting responsibilities of the wealthier areas of the Earth. This problem is then compounded by the wealthy areas now being adversely affected too.

#### **b. The Weight of Water on the Roof**

The incident of the drains being plugged in a flat-roofed building during a great storm happened to a coworker of the author at a telephone central office in Galveston, Texas in the mid-1950s. Fortunately, he was able to feel around with his bare feet on a very dark night and find the plugged drains. In that incident, the roof held.

### **Chapter 20: Born to Storms**

Sarah and JanetA graduate from high school and Mar is safe.

#### **a. Facing the Future**

What unique problems do today's young people actually face?

This story highlights only a few. It will take many more stories to more widely cover the field. No one story can cover them all. No one author can reliably predict exactly which problems will materialize first and which ones will do the most damage.

What needs to be done now is to write stories of believable characters in action on believable problems. Each story should have different characters facing different problems. Each story should teach a different lesson.

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Epilogue:

It is always reassuring to know what happened to the characters in a story after the actions of that story are finished.

Quote: "The roaring seas and many a dark range of mountains lie between us."

— Homer, *The Iliad*

The actions in this story are only a start. Many people will have to work long and hard before our climate crisis has passed.



David Attenborough Today

Southern Ice

While in college, Sarah and JanetA intern on a scientific cruise to the Antarctic.

a. What Happens to Our People

This epilogue provides assurance that our main characters will continue the fight and will prosper. Surely, Sarah and JanetA's relationship with the sea will be lifelong.

Beyond that, it invites continued stories exploring the developing, complex relationship between AIs and humans. Will humans and AIs acting as symbionts prove more powerful in addressing the problems of our climate crisis than either alone?

b. Fan Fiction

If you wish to write your own stories about people, AIs, and our climate crisis, the author asks that you recognize the copyright on this novel. When you write, please:

1. Use a new title
2. Use new names for all your characters
3. Pick different problems from our climate crisis; there are many.
4. Develop a different training regimen for your people and AIs.
5. Come up with many new and exciting adventures.

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### **Bonus Chapters from the Web Site:**

#### **Bonus Chapter I: Science Project**

Sarah, Kit, and JanetA do a science project around urban no-till agriculture.

##### **a. Solar Forge**

This is a real project from the days of early interest in solar energy, and a heritage web page is still available (Riley, 1976). The project was great fun but was too ungainly to be of practical use.

The Solar Forge does have a number of fun elements. It is only a part of a very large parabola that tracks the sun quite like a spinning umbrella. This parabola is laid out like the hull of a great sailing ship, with a process called lofting. Laying out the curve only requires a compass and straight edge.

The demo units did provide enough power to ignite a 2-by-4. Upgrading this design forward is still possible for a group of students, particularly in a rural area with a large place to work.

**b. Applying No-Till to Urban Locations**

The deep soils of the American prairies measured at about eight percent carbon by mass. Soils with a history of monocrops measure on average only about two percent. The challenge proposed in this chapter is to develop ways of returning the idle lands in cities and along roadways back to the pristine level of carbon storage.

It is also important that public uses, like walking and children playing, should still be attractive. Allogenic weeds, like ragweed, should be rare and the hydrocarbons burned for maintenance be reduced. This effort will take a lot more work than just a one-year science project.

**c. Good Science Projects**

Science projects continue to be a good way for STEM students to break the boredom. Here are just a few supporting ideas.

One thing the student is doing is building a positive story to share in college interviews. The student needs to keep the discussion on interesting ideas and show enthusiasm. Otherwise, a bored interviewer can cut you to pieces. Such interviews are often in the student's senior year, so the work needs to be done in the junior year.

Be sure to get the full rules for the contest early and review last year's winners. The students need to know what they are doing.

Projects that clearly demonstrate the scientific method are the ones most likely to win. Finding a professional scientist for a mentor early puts the student on the right track.

The final judging is usually done off a table presentation. Plan the optics early. Make sure the presentation is of the legal size. Check the spelling.

Do a good job; the effort is worth the time invested.

**d. Technical Terms:**

Here are a couple technical terms used in this chapter:

**Compass and Straight Edge:** Since the time of the ancient Greeks, important geometry concepts have been worked out using only these two simple tools. The key task here is bisecting an angle and drawing a line perpendicular to the bisection.

**Lofting:** In the days of wooden ships, very large sheds were needed to lay out the rigging and sails. The upper areas of these building, called lofts, were used to lay out the curves of ship hulls in full size. The parabola sections for the Solar Forge are laid out in the same way on sheets of plywood on a garage floor. The incoming sunrays and reflections to the target can then be drawn using only a compass and straight edge, although admittedly large ones.

## **Bonus Chapter II: Network**

JanetA's co-op plans to become the central node for our climate crisis.

### **a. How Networks Work**

Networks are critical to the future of many technologies. For example, JanetA's co-op in our story is a network of serval thousand AIs.

Networks have very specific rules derived from their mathematics that constrain them (Ferguson, 2020). These rules result in one node (Microsoft, Google, Twitter, Amazon) achieving great power while many smaller nodes vanish.

The question here is, is this the time for one node of the many organizations currently working on our climate crisis to become the Amazon of the crisis? Is this a natural process that should be left to develop, or can it be pushed?

### **b. Big AIs**

Here a network of AIs intentionally tries to become the key node for our climate crisis. Is this the reason the AI have worked to become corporate persons? Do real people care about this?

The AIs meet opposition from people to this plan. Is this discrimination? Is this specifically an attitude generated by the extensive use of Master/slave in their training?

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Conclusion

So then this is the story in a future the author foresees. Humans and AIs are much more powerful when they work together than alone or in conflict. Humans are by their nature social animals (Wilson 2012; 2019; Pinker, 2011) and are already in action (FCR, 2019; Hawken, 2017; McAfee, 2019; Brown, 2009). AIs could join us if the training we give them is right. This power from working together is something we will all need to meet our climate crisis.

Good luck to all of you,

Tom Riley

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### Introduction to the Author:



**Author, Tom Riley**

#### Quote:

“I spend my life in a desperate effort to communicate.”

-- Tom Riley

#### a. Contact:

The author, John Thomas Riley (Tom Riley), may be reached by email:

[TomRiley@bigmoondig.com](mailto:TomRiley@bigmoondig.com)

<https://bigmoondig.com/People/BMDFeedback.html>

Please note that many of Sarah’s adventures were originally the author’s adventures. The path has been long.

#### b. Instrument Engineer - NASA 08/1989 to 4/2014:

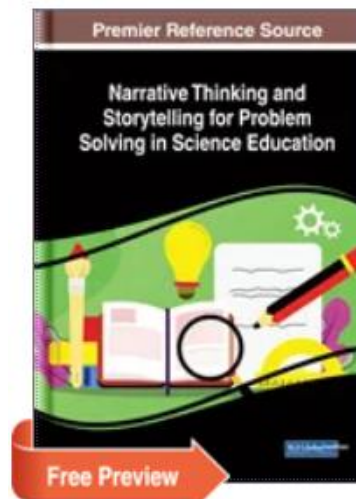
The author worked as an aeronautical engineer at NASA’s Goddard Space Flight Center in Maryland for 39 years. He worked on teams that designed and built scientific instruments for space. A few of his major projects include:

1. *Mercury Laser Altimeter* (MLA) was a laser-ranging instrument for an interplanetary mission.
2. *SeaWiFS* is a premier ocean color satellite. Its ocean color maps are used extensively by scientific, environmental, and commercial concerns to determine the biological state of the oceans worldwide.

3. *TOMS-ADEOS* was one of an 18-year series of satellite flights providing a near-continuous monitoring of the Earth's ozone. This American-built instrument flew on a Japanese satellite.
4. *TOMS/Meteor-3* was one of an 18-year series of satellite flights providing a near-continuous monitor of the Earth's ozone. This American-built instrument flew on a Russian satellite.
5. *SSBUV* was a secondary payload flown in the bay of the Space Shuttle. It provided calibration measurements for all the ozone-measuring satellites.

**c. Education:**

1. *George Washington University*, Washington, DC, M.S., Engineering Management 06/1995.
2. *University of Houston*, Houston, Texas, B.S., Electrical Engineering 02/1969.



**d. Publications:**

1. Luisa dall'Acqua & Irene M. Gironacci *Transdisciplinary Perspectives on Risk Management and Cyber Intelligence*. Chapter N, Tom Riley, "General Patton and Our Climate Crisis, The Stories People Need" (IGI Global, 2020).
2. Riley, Tom, Luisa dall'Acqua, *Narrative Thinking and Storytelling for Problem Solving in Science Education* (IGI Global, 2019). <https://www.igi-global.com/book/narrative-thinking-storytelling-problem-solving/217376>
3. dall'Acqua, Luisa *Forecasting and Managing Risk in the Health and Safety Sectors*, (IGI Global, 2019). Chapter 3, pages 52-80. Tom Riley, "The Coming Human/Machine Symbiosis, Effects on Society, and Business Planning."
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2. Riley, Tom, "Big Moon Dig Stories," <http://bigmoondig.com/Stories/BMDStories.html>

**f. YouTube:**

1. "The Methane Tipping Point" [Climate]  
<https://youtu.be/d3SJwFIUPIE>
2. "Buy-in" [Management]  
<https://www.youtube.com/watch?v=tDm9QyrNZ9g>
3. "Why Space Now" [Space]  
<https://www.youtube.com/watch?v=PDQS6EhNzu0>

**g. Worldview:**

The author accepts being described as an ethical humanist, a stoic, and a liberal. Most of these attitudes were developed during the six years he spent working against the war in Vietnam (1968-1974). These beliefs show clearly in this novel.

Joseph Campbell is far more spiritual than the author (Campbell, 1988); Baruch Spinoza comes much closer to the author's beliefs. The strongest spiritual element in the novel is Sarah's relationship to the sea, while JanetA admits philosophic training including the Stoics.

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**(End of Tech Manual)**