DUTY CALLS

By **Ted Bann**

"Duty Calls" First UK edition 2015

This Kindle edition first published in 2015 by Ted Bann

First published in Great Britain in 2015 by Ted Bann

www.tedbann.com

DUTY CALLS

Ted Bann

For the first thirty Wakings we made a game of it, didn't we, Ella.

In the message I Woke to, you would describe what you saw yesterday, in some part of the Ark newly formed. You would tell me about the bright sheen of its engineered nanocarbon, noting the angles between the gleaming polygons of its substructure.

Your measurements were always precise. I was perhaps the better Mathematician. But you, dear sister, were the better Engineer.

Then, in the few days' grace between Waking and Work, I would take your sizings and sketchings, and set out for the far reaches of our fragile vessel. Dead reckoning across hundreds of kilometres of structural diamondoid, in the comforting folds of my nanosuit, I would search. Aiming to find the exact spot where you stood among those fresh-grown folds and surfaces, yesterday.

Twenty-one times among thirty, I found it.

And gazed at sheets and struts long dulled by pits and pockmarks. At structural folds loosened by inertia, at surfaces scarred by a billion specks of stardust.

Twenty-one times, I stood where you once stood. In your yesterday, a hundred years ago.

I am four thousand years old.

I am a hundred and ninety-one.

I am a boy of seven.

****

Of course, we had all heard the murmurings. But it was not until my forty-first Waking that the Great Failing became unequivocal. (You learned of it earlier, on your thirty-seventh.)

As resources grew scarce, our shifts had lengthened and desynchronised, although never in the way we both wanted. The murmurings turned into calculations, and then into facts.

Our Ark did not have the resources to reach Kepler.

Kepler-186f had been among the first Earthlike worlds discovered, many centuries

back. Five hundred light years distant, close on the scales of the cosmos. But with our Earth all but dead, crossing that span would prove a monumental goal.

Even in the last days, the politicians bickered, the engineers complained, the bankers did what they always do. Every design change took more resources; more resources meant greater mass for the Ark at the outset; greater mass meant slower acceleration and a longer journey time.

The equations were so finely balanced that bare grams for every tonne of ship's weight were the difference between success and failure.

Then came an idea: the missing mass would be found on the way.

The emptiness between the stars is not *wholly* empty. Scattered in space are free-floating atoms and diatoms, mere dozens per cubic metre on average, but they exist. Down a pathway half a thousand light years long, those specks and pebbles would make up the numbers.

Engineers designed a ship that would capture them, scooping them into its vast maw for use as feedstock and reaction mass. With the help of that extra percentage point, our Arks would reach their stars.

But averages are just averages.

On that Waking, I gazed into your sarcophagus, as I always did. At your face, no longer that of a five-year-old, but of a beautiful young woman. If your eyes had been open, I am sure they would be the same eyes I remember from our youth. A young girl's eyes, laughing in the light of an angry Sol.

But we never Sleep with our eyes open. Perhaps for the best. What would eyes look like, in a body whose every protein hangs in a scaffold of nanomachinery that turns all life's liquids into something like glass?

The zero timelapse in the sarcophagi means each message from you, written decades ago, sounds to me as fresh as yesterday. Until, of course, your thoughts turn to work. You talk proudly of projects numbered with job codes an order of magnitude lower than mine. Of jobs you finished in your shift that would last for centuries. Jobs that by the time I Woke would have long been returned to their base molecules, feedstock for the ever-widening cobwebs of carbon that prepare our Ark for its final task.

****

Ah, how our great machine has blossomed on its journey. There have been three great blossomings, each slower than the last, and the third will continue nearly all our days.

That first blossoming, an orchid. The mathematically precise structure of folds that entombed our sleeping bodies when the Ark was first in Earth orbit, at the beginning.

As we slept our way across that first light year, the orchid expanded from a near-solid polyhedron to the place of spaces in which we Woke for the first time, somewhere beyond the Oort Cloud.

Was it not wondrous, Ella, that first Waking? All those flattened sheets and layers now become great corridors, triangular in cross-section. Connecting the pyramidical halls, the tetrahedral bays and docks for the vast farms, the warehouses, the already-gnashing workshops in which we would build our future.

We had time to enjoy back then, far more than the brief hours allowed us on each Waking now. Did you feel the same enchantment at our new home, soured only by sadness that we could not experience it together? I believe you did.

Of course, it was some time before they broke the news to us that we were alone. That our parents and grandparents, even our other sibling—I cannot even remember his name, now—had not passed the Tests, had none of the intuitive facility with code and equations and dynamic systems the Arks demanded. In most families, such skills run down the generations. In ours, we were the first.

But we were together, Ella. Together, my sister and greatest friend.

Sometime after that first parsec, the orchid-shape of the Ark experienced its second blossoming. It became a rosebush. A vast tangle of superstructures and substructures many kilometres across. A form that ghosted an idea of what the Ark would one day become, what its designers intended it to be.

At first we humans lived and worked in that crushed orchid near the centre, but as the branches and petals of the vast carbon rosebush thickened and solidified, and air whooshed in and around the spaces they marked out from the harsh vacuum, our little world became larger.

Designed on the principles of Life—allowed to grow and adapt to the circumstances we

forced upon it—the Ark's eventual structure was only known in the broad sense. Those early Wakings were such a time of discovery! Mapping the spaces that had grown while we Slept, and slotting them into jobs of Work to see which goal each space could fulfill.

Even then, before the Great Failing, it was known the resources to reach Kepler-186f—to reach *any* of the Earthlike planets we knew so much about, but which were so far away—were balanced on a razor's edge. So nothing was wasted, not an atom ever left the Ark save the ions pushing us towards Kepler-186f infinitesimally faster each year.

But our lives were not of toil and tears. With purpose and meaning in our Work, we were happy, even joyous, were we not? A new life awaited humanity, many Wakings hence: thousands of years to those left behind, but mere decades in the time-shifted world of the sarcophagi.

Then as its relative inertia intensified, racing across the cosmos at approaching eight percent of lightspeed, the Ark switched metaphors again.

No more a rosebush, with a pleasing fractal geometry, but an algal bloom. A vast bowl-shape of stiffened tendrils trailing an immense tail. Constantly reinventing itself, eating itself, building itself out. The bowl angled forward, to gulp what sustenance it could from the hard vacuum of interstellar space.

Just kilograms each year, yet those few handfuls of dust stolen from between the stars were the difference between success and failure in our calculations of mass and energy.

It says a great deal about how we humans treated our planet, doesn't it, Ella. That our follies and foibles left so little of value in our own soil . . . that our escape across hundreds of light years depended on harvesting the occasional organic molecule from the infinite dark.

Eight percent of lightspeed.

And that was the first whisper of the Great Failing.

It should have been closer to nine.

****

Today is my sixty-third Waking. (They come sooner, now.)

We Wake for a few months or a year. Train when we are young, take up Work when our training is complete. Then sleep for many decades while others Wake to take our place.

Already, the equation between those needed to maintain the Ark and the number of Waking lives it can sustain allows little margin.

I look forward to reading your messages later, Ella, despite the fog of fatigue that envelops the last hour of each day of Work before sleep. (Real, natural sleep, not the Sleep of the sarcophagi. I have been told this shift will last several months.)

Behind the diamondoid faceplate of your sarcophagus, I see you have reached the age where change is gradual. A woman grown handsome, experience written in the footsteps of crows around her eyelids.

(Do you remember crows, Ella? Our parents used to deride them, treat them as vermin. They were common on our baked Earth towards the end. What would any Human give to see a crow now, soaring and cawing amid these gigantic structures that now approach a full light-second in length?)

You are my little sister.

You are a woman in your forties.

You were born thousands of years ago.

I have slept by your side for centuries. But in all those thousands of years, dozens of Wakings, we have never been awake together. Not even for a single overlapping day between shifts.

I would hate those who made that decision, if I were not a Mathematician able to understand why.

During those early Wakings, we assumed it was a problem that would be solved. Life itself was a game then, wasn't it? The tasks assigned to children were simple, even enjoyable. In those Wakings, children played in the great corridors, and when their memories of Earth and family faded, there was laughter again as shared experiences on the Ark replaced those of family life back on Earth.

I looked in your sarcophagus on my ninth birthday, on tiptoe to reach within a hand's span of your sleeping face, and whispered that it would not be long now.

Of course, I was mistaken.

The rosterers had a preference for keeping relatives Woken at the same time: family ties build strong teams. But it took many Wakings—our education and training rosters

were different—before the subject could even be raised. And by then, the Great Failing had stamped itself on every resource allocation and work plan. Your skills and mine were matched to different teams, and the luxury of changing rosters was no more.

Oh, that the Ark's designers had allowed for a greater margin of error! The specks that feed our ship are too far apart in the cold between the suns. Few are needed, but even fewer are there to be taken. And we discovered we were using too many of them.

We have slept in the same room nearly every night for four thousand years, Ella, our twin sarcophagi reverently side-by-side. But we have not spoken since you were five years old.

And I miss you so much, my darling sister.

****

And then we started to die.

We were not supposed to die. The centuries-long lifespans our technology allows, combined with our long sleeps in the sarcophagi, should have allowed every woman and man on the Ark to wave to a planet twice: once in farewell to Earth, and again in greeting to our new home.

But the Ark is sliding through space more slowly than its designers planned, and can accelerate with no more force than a cough. We must rely now on our momentum and a course plotted centuries ago; barely ten kilograms of matter can be spared for the drives each year. The doldrums of Earth's old oceans, re-imagined in the blackness of space.

The first death happened during my eighty-seventh Waking.

His name was Lauden. Well into adulthood when we left Earth, old to us then but not the oldest. Dutiful for seventy or more shifts, then from one Waking he never emerged.

He was kind, like our father. Did you ever meet Lauden, Ella? I understand your Wakings sometimes coincided with his.

Not many have died since. Most of the thousands who started this journey remain *biologically viable*, as our medics would say. But the centuries added to our journey by the Great Failing place us on another razor's edge. Whether this edge will make the unkindest cut is not yet known.

Ah, Mr Lauden.

There was a ceremony, of course. A few malcontents wanted his body to be committed to space. But the seventy kilograms of resources in a human body are worth centuries to us.

The Ark is our Earth, and its fabric of nanomachines our soil.

So there is part of Lauden buried in the latest superstructures, part of him in the Bowl, part in our life support systems. All those billions of nanomachines whirring at the atomic scale as they take apart complex molecules, reformatting them into sheets of doped graphene and bundles of fullerenes, computing masses and drive geometries. And part of him lies far to our rear, ejected as ions that push us one more infinitesmal fraction towards *C*.

Ashes to ashes. Dust to dust. And from both, new life. For our ship, and for ourselves.

I have no such fears for you, Ella. Younger than me, and healthy. The face in your casket is still yours. A woman long past the age of childbearing, but with her muscles and wits intact.

Will humanity yet die on Earth? Did we, for all purposes that matter, die long ago when our planet turned to dust? Perhaps we humans were never truly destined to travel among the stars. We will never hear from the other Arks; the distances between us are too great for even Light to bridge.

I try to put such thoughts aside. As we must put aside Lauden. Goodbye, my friend. You were a good man.

****

They have changed the décor on us, Ella.

It is the same room I last Woke in, but it is smaller on this Waking. (My hundred and fortieth or so? I have stopped counting.) It is the same width, but its length has been truncated to feed the Ark, the stuff of its surfaces and folds eaten by the machines to recycle and repurpose spaces vastly larger. The great Bowl that leads us through the cosmos measures five thousand kilometres across, and the tendrils that trail it many millions.

With 99% of the fuel we took from Earth orbit exhausted, we are travelling at over a third of light speed. For the ship, it has been a three-thousand year journey already.

Many more have died. We now share our Ark with fewer than one thousand. Those who

are left are, perhaps, the strong ones. There have been fewer deaths in recent Wakings. Perhaps there is cause for optimism.

The optimist would judge our progress by the calendar, and say we are more than halfway there. The pessimist, by distance, admonishing that hundreds of light years remain to be travelled. Optimism and pessimism are great drivers of society.

You have told me that you indeed knew Lauden. I am happy. He was a good match for you. Did you yearn for children? I have yearned, too. Of course, that was one mission requirement too many.

When the great plans were made, three thousand years in our past, it became clear that an early vision of the Arks being true living Worlds—colonies, with children being born, growing to adulthood, and having children of their own—contained too many variables to entrust Earth's last resources to.

On a journey of five thousand years, society changes, and not even the best psychologists could predict how. We could not assume generations as yet unborn would adopt the ideals of their parents. The fine ambitions and noble sacrifices of a first generation can only do so much, if that generation will expire barely one percent into the journey.

So it was decided that for the Arks to truly answer the yearnings of mankind, without imploding under the pressure of its dreams, those who entered the ships in Earth orbit had to survive the Ark's entire journey. And so we sleep away the long years between shifts in our sarcophagi, cold yet smiling, full of hope.

That was the dream. That as Earth lay dying, some of its sons and daughters—despite a journey longer in time than that between us and the Pharoahs—would step onto the shores of humanity's new home. A dream then five hundred light years distant.

And now just two hundred and seventy-five.

****

It is my four hundredth Waking. Or so close to that number it does not matter.

Do you know what I did today, Ella? I searched the earliest parts of my databox, reviewing some of our earliest exchanges on this Ark of ours. Some of them I can no longer read. As the ship's software has evolved, many old data formats simply went away. I have

lost count of the times your messages mention an image, a holo, a piece of music you laughingly composed; but there were few I could even locate, let alone enjoy.

Our journey has become an endurance test. Can the Ark eke out enough energy from those few grams it collects from the vacuum of space to deliver some part of its human cargo to Kepler-186f? Well . . . perhaps.

I look for the four hundredth time into your sarcophagus. The face is that of an old woman now, careworn and tired, but kind.

All the Great Failings, estimations of resources that turned out wrong in the fifth place of decimals, have positioned our Ark's mission even closer to the edge than the calculations anticipated. And the side effects of the endless Sleeps have reduced our longevity to merely Methuselan. We have all Slept and Woken far more times than the mission designers ever planned, and it has taken its toll on our bodies.

We are so near, yet so far.

Perhaps only a fifth of our long journey remains to be covered. Mere centuries, against the millennia we have already travelled. But even with our skeleton crews, shifts of sixty men and women doing work planned for four hundred, our Ark may not make it to Kepler-186f with a cargo worth unloading.

(Why do so many planets around suns separated by thousands of parsecs share the name of that ancient astronomer? I have never thought to wonder.)

I was happy to learn on Waking that no-one is dying now. The last death happened over thirty years ago, and no more are expected. But we give thanks to those whose bodies are now part of the Ark, whose atoms give an extra breath to our acceleration. Their remains improve our odds.

A chance that was in the darkest times calculated at just one in thirty thousand has improved. Some Mathematicians now believe it better than one in fifty.

I am not among them. My mind no longer functions as it did; the work I can do is minor. But I concentrate, and I complete my shifts, and I return to my sarcophagus when my months are done, pressing my lips against your sleeping face a few centimetres away beneath the glass. I used to wish you sweet dreams. Now, I wish you a good Waking.

(Your next Waking is scheduled for barely a week hence. So close! If only I could remain

on shift for seven more days. But the resource calculations forbid it, and I must obey them. After all, I was responsible for many of them myself.)

But the ennui of my last hundred or so Wakings has largely departed, dear sister. When you Wake, you may sense it among those on your shift, too. After centuries of doubt that we would ever make planetfall, a one-in-fifty chance is cause for celebration. And with the deaths at an end, hopes are high. But the calculations are getting harder.

It is strange to think that with so much distance still to cover, the equivalent of a palm's pressure on our Ark's hull would make the difference between success and failure. I imagine your five-year-old self standing outside in space, unafraid in the vacuum, laughing as your tiny hands pushed those odds to one-in-five and better.

The image stirred strange ideas, dear sister. And on my next Waking, I must share with you some serious matters.

I must tell you when you must die.

****

The Ark has turned!

It happened before my most recent Waking, but I see from the schedules you were on shift, Ella. Did you imagine you felt the change in momentum, as the millions of kilometres of tail swung over the vast bowl that has led us through space for millennia, to now point ahead?

What was fore is now aft. What accelerated, now decelerates. According to the plan, the tips of those long tendrils—all that evolved nanomachinery you and I have been guiding into existence for hundreds of shifts, thousands of years—will brush their wispy edges against the upper atmosphere of Kepler-186f in just a few centuries, as the Ark comes to a halt.

As the planet spins beneath us, those filigree threads will whip against its lower atmosphere, and some of them will snag. Millions will break, but many will impart momentum. Over time, the Ark will gently accelerate again, going into orbit around our new home, matching its velocity with the planet's spin . . . and the Ark will *reel itself in*.

In time, Kepler-186f will be still and silent just a few dozen kilometres beneath our forest of waving fronds. Ready for the vast bowl of our Ark to settle onto its rocky surface

like a suction cup.

Under the bowl, the Ark will complete its final function: terraforming that patch of the planet into a place we can live, in a broad and shallow dome thousands of kilometres across. Perhaps the most audacious piece of engineering mankind ever imagined: a plan to capture a future for humanity the way a giant squid captures its dinner.

One last hurrah for human ingenuity, as our green and lovely Earth succumbed to the ignorance of past generations, and the seas rolled over the cities and the meadows turned black.

But the odds have lengthened again, to one in two hundred or so. The Engineers say had we started our journey with just one extra tonne of feedstock, we might have made it. Everyone on shift continues to go through their motions, but resignation is beginning to set in.

I am a hundred and ninety-one years old, and I am tired. But I have found a way to reduce those odds.

I was the better Mathematician.

Oh, I wish we had spoken, Ella! Just once, before we both pass on. How we, as children, both laughed at the thought that one day we might both have children of our own, yours with hair the colour of flames, mine with near-black. We talked earnestly of who our wives and husbands should be, and then we linked our fingers and promised that no matter what happened in our lives, the best brother and sister in the world would always be together.

And so we shall be.

In my last shift, since the strange dream of your five-year-old self pushing us towards our destination, my calculations took a different turn.

Improvement of our survival odds to better than one in two—to virtually certain—will take approximately one hundred and nine kilos of feedstock and reaction mass, delivered into the Ark's systems at a precise time and in a precise way.

Together, you and I weigh one hundred and ten kilos.

Ella, are you with me?

****

Shift six hundred and thirty-eight.

Ella, do you remember your first Supervisor as you reached Work age, who told you that our schedules could never coincide? I think mine was called Darblay. He was sympathetic but shrugged. Rosters were set so far in advance, the Work requirements interlocking so firmly, that even the love between a brother and sister could not loosen them.

The irony is that in this Waking, that same Supervisor agreed to your early Waking! So that our shifts could overlap by a few days. In his mind—most seem to have given up—the extra resource expenditure matters little now.

But I have learned what it might cost.

Every year our chance of reaching Kepler-186f falls, and even one changed shift could cost us everything.

So thank you, dearest sister. I knew you would agree.

You saw the logic immediately. Among those who remain, it is you and I who have worked the longest shifts, logged the largest number of Sleeps. We were among the youngest when we came on board, after all, and have spent the most time awake. So even if we were to reach our goal and step onto the surface of Kepler-186f, we might not be there for long. We are tired; but in our exhaustion shall come our triumph.

Our bodies shall feed the ship, so it can complete its long journey.

Now, to details. On your next shift, you must use my calculations to design the algorithms the Ark needs. Instructions that can guide it to make use of precisely one hundred and nine kilograms of working mass when all seems lost. I have tried to write some broad specifications—they are attached—but the spark of design genius needed is far beyond my skills.

You were always the better Engineer.

Check your locker at your next Waking. There will be a small package for you, a tablet of chalky chemicals I have sieved together from micrograms of dust over the last few decades. A single pill you must take before you enter your sarcophagus for the last time. It will do the job we have decided to do, quietly and without pain.

I have already taken mine.

As we were told thousands of years ago and we still believe now, the mission is all. We must reach our Kepler. And, finally, we shall.

The great mass of technology beneath our feet *will* reach out to Kepler-186f, to stroke and tickle and grip its alien air. The carbon ropes *will* catch and tug, peeling and shredding apart and uncoiling, down through its atmosphere to its vast, warm oceans.

When our sarcophagi confirm our deaths, the machines will accept our carbon and hydrogen and oxygen, suck our remains through a billion whirring little cogs and rods and tubes and make machines of us. The beautiful patterned nanostuff, evolved and intelligent, that makes up our great vessel.

Have you ever wondered whether it thinks, Ella? Whether this Ark of ours is sentient? If so, perhaps the souls of those who have sacrificed their bodies to the feedstock vats somehow remain within its structure. They are committed to the vats whole, after all, preserved in the glass of the Sleep.

And the structure of the ship—well, it wastes nothing of value. Perhaps it retains what it consumes, as patterns. Perhaps those patterns persist. I know not. But of one thing I am sure: our Ark loves us. It has brought us so far, at such cost. I believe it is in pain. But our plan will salve it.

When the nanoropes descend, I wish fondly that you and I—rather, some clump of matter that used to be known as you and I—will be the first. Because it would make us pioneers. The first to touch the alien world on which we set our hopes, four thousand years ago.

There is no sadness in my heart, Ella. For the first time in so many centuries, my thoughts contain nothing but joy.

****

And now, dear sister, it is time for me to Sleep. I have worked my final shift and my time is done.

Do you remember the day before we left, Ella?

Mother and Father took us to the beach, the edge of that ocean once called the Atlantic. That in startlingly few years had expanded to cover our once-large country in water so warm it steamed. Oceans without fish, rolling over soil without plants. A dead world, but I remember that last day with great happiness.

We entered the water, not caring if it wet our tunics. Mother and Father never told us

they could not join us, that the Arks were for the young. And we were among the youngest. But they knew we had a chance at a new life under another sky. I like to imagine them saying goodbye, as we went into our first Sleep and our sarcophagi were labelled and loaded.

That was our first Sleep. I go now into my last with that memory shifted to another world, Ella. A memory yet to come, but because of our actions, now certain to happen. To someone, somewhere.

Would you like to know what that memory is?

It is of an old civilisation connecting with its new home.

It is of people thousands of years old setting foot on an alien planet.

It is of a seven-year-old boy and his five-year-old sister, splashing ashore on a warm beach.

I go into my final Sleep with great optimism, Ella. Our Ark was the first. But perhaps in these thousands of years there have been others. Perhaps hundreds of later Arks have already completed their journeys to other Keplers.

Perhaps around alien suns that were once merely stars in our sky, children learn and play and dance to the distant echo of our home planet’s death rattle.

Perhaps we have learned enough to treat our new homes better than we treated our first.

And we shall be together again. You, a girl of five, and I, a boy of seven. And after five thousand years, we shall be free. To laugh and dance in the ocean of humanity's newest dawn, brother and sister reunited in joy, forever.