

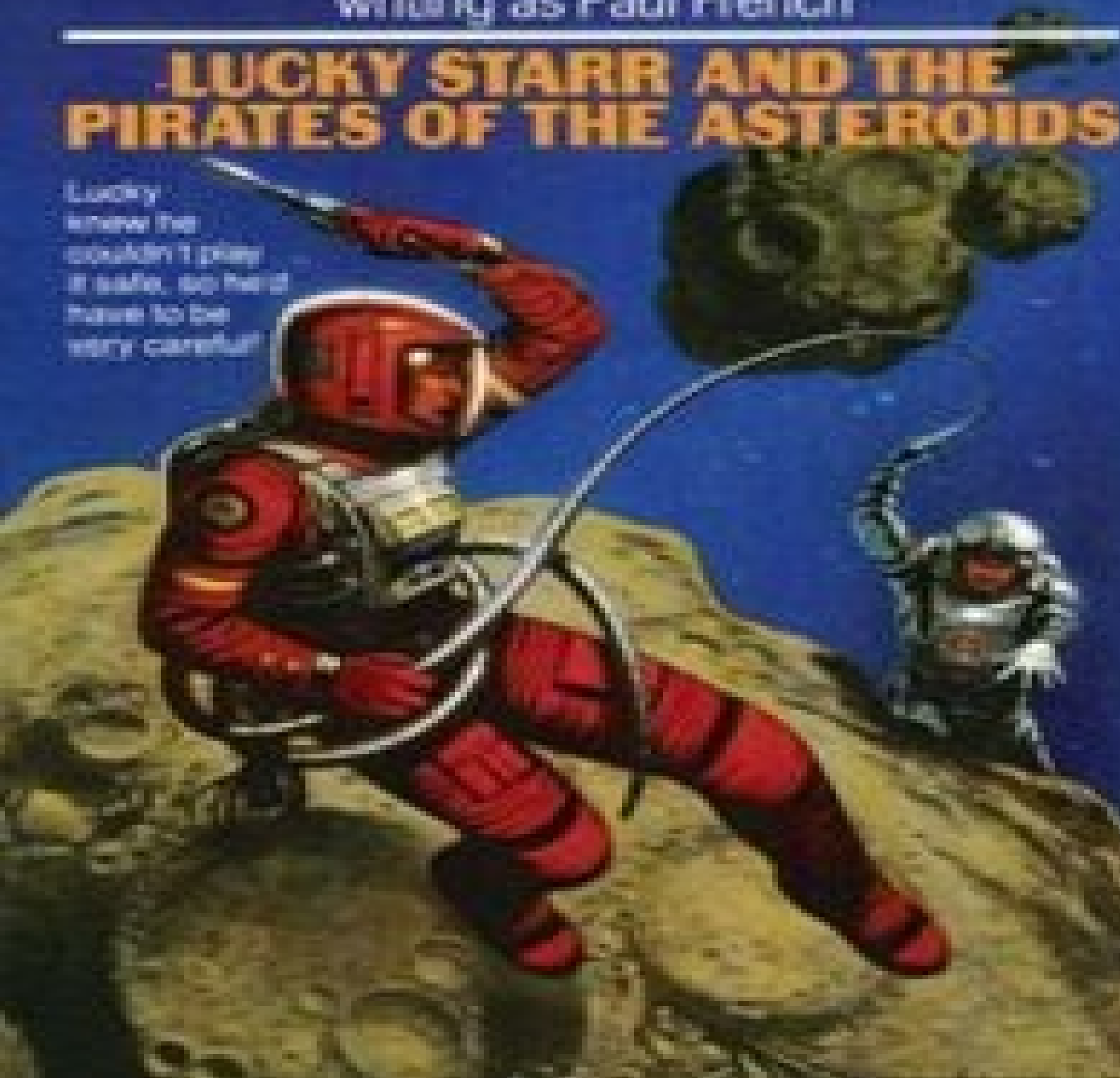
# SCIENCE FICTION ADVENTURE

ISAAC  
ASIMOV

writing as Paul French

## LUCKY STARR AND THE PIRATES OF THE ASTEROIDS

Lucky  
knows he  
couldn't play  
it safe, so he'd  
have to be  
very careful!



---

# **Lucky Starr and the Pirates of the Asteroids**

*( Lucky Starr - 2 )*

**Isaac Asimov**

---

**Isaac Asimov**

**Lucky Starr and the Pirates of the Asteroids**

**(Lucky Starr – 2)**

---

# Preface

Back in the 1950s, I wrote a series of six derring-do novels about David "Lucky" Starr and his battles against malefactors within the Solar System. Each of the six took place in a different region of the system and in each case I made use of the astronomical facts-as they were then known.

Now, a quarter-century later, Gregg Press is bringing out the novels in new hardcover editions; but what a quarter-century it has been! More has been learned about the worlds of our Solar System in the last quarter-century than in all the thousands of years of earlier observations.

Prior to the 1950s, you see, we could only look from Earth's surface; since then, we have been able to send out rocket probes to take photographs and make studies at close range.

The only one of the six Lucky Starr novels that has remained untouched by this-at least so far-is *LUCKY STARR AND THE PIRATES OF THE ASTEROIDS*, which was written in 1953. There is some evidence that many of the asteroids may be a little darker and just a little larger than had been thought earlier, but that makes very little difference.

Therefore, Lucky can fight the pirates and engage in his deadly duels right now just as he did a quarter-century ago, when this book was written. If I had to write the novel today, I would hardly have to change a word.

Isaac Asimov

*DEDICATION*

*To Frederik Pohl,*

---

*That contradiction in terms-*

*A lovable agent.*

---

# Chapter 1

## The Doomed Ship

*Fifteen minutes to zero time!* The *Atlas* waited to take off. The sleek, burnished lines of the spaceship glittered in the bright Earthlight that filled the Moon's night sky. Its blunt prow pointed upward into empty space. Vacuum surrounded it and the dead pumice of the Moon's surface was under it. The number of its crew was zero. There wasn't a living person aboard.

\* \* \*

Dr. Hector Conway, Chief Councilor of Science, said, "What time is it, Gus?"

He felt uncomfortable in the Moon offices of the Council. On Earth he would have been at the very top of the stone and steel needle they called Science Tower. He would have been able to look out the window toward International City.

Here on the Moon they did their best. The offices had mock windows with brilliantly designed Earth scenes behind them. They were colored naturally, and lights within them brightened and softened during the day, simulating morning, noon, and evening. During the sleep periods they even shone a dim, dark blue.

It wasn't enough, though, for an Earthman like Conway. He knew that if he broke through the glass of the windows there would be only painted miniatures before his eyes, and if he got behind them then there would be just another room, or maybe the solid rock of the Moon.

Dr. Augustus Henree, whom Conway had addressed, looked at his wrist. He said, between puffs of his pipe, "There's still fifteen minutes. There's no point in worrying. The *Atlas* is in perfect shape. I checked it myself yesterday."

"I know that." Conway's hair was pure white and he looked older than the lank, thin-faced Henree, though they were the same age. He said, "It's Lucky I'm worried about."

"Lucky?"

Conway smiled sheepishly. "I'm catching the habit, I'm afraid. I'm talking about David Starr. It's just that everyone calls him Lucky these days. Haven't you heard them?"

"Lucky Starr, eh? The name suits him. But what about him? This is all his idea, after all."

"Exactly. It's the sort of idea he gets. I think he'll tackle the Sirian Consulate on the Moon next."

"I wish he would."

"Don't joke. Sometimes I think you encourage him in his idea that he ought to do everything as a one-man job. It's why I came here to the Moon, to keep an eye on him, not to watch the ship."

"If that's what you came here for, Hector, you're not on the job."

"Oh well, I can't follow him about like a mother hen. But Bigman is with him. I told the little fellow I would skin him alive if Lucky decided to invade the Sirian Consulate singlehanded."

Henree laughed.

"I tell you he'd do it," grumbled Conway. "What's worse, he'd get away with it, of course."

"Well, then."

"It would just encourage him, and then someday he'll take one risk too many, and he's too valuable

a man to lose!"

---

\* \* \*

John Bigman Jones teetered across the packed clay flooring, carrying his stein of beer with the utmost care. They didn't extend the pseudo-gravity fields outside the city itself, so that out here at the space-port you had to do the best you could under the Moon's own gravity field. Fortunately John Bigman Jones had been born and bred on Mars, where the gravity was only two fifths normal anyway, so it wasn't too bad. Right now he weighed twenty pounds. On Mars he would have weighed fifty, and on the Earth one hundred and twenty.

He got to the sentry, who had been watching him with amused eyes. The sentry was dressed in the uniform of the Lunar National Guard, and he was used to the gravity.

John Bigman Jones said, "Hey. Don't stand there so gloomylike. I brought you a beer. Have it on me."

The sentry looked surprised, then said regretfully, "I can't. Not when I'm on duty, you know."

"Oh well. I can handle it myself, I guess. I'm John Bigman Jones. Call me Bigman." He only came up to the sentry's chin and the sentry wasn't particularly tall, but Bigman held out his hand as though he were reaching down with it.

"I'm Bert Wilson. You from Mars?" The sentry looked at Bigman's scarlet and vermilion high-top boots. Nobody but a Martian farm boy would let himself be caught dead in space with them.

Bigman looked down at them proudly. "You bet. I'm stuck here for about a week. Great space, what a rock the Moon is. Don't any of you guys ever go out on the surface?"

"Sometimes. When we have to. There isn't much to see there."

"I sure wish I could go. I hate being cooped up."

"There's a surface lock back there."

Bigman followed the thumb that had been jerked back across the sergeant's shoulder. The corridor (rather poorly lit at this distance from Luna City) narrowed into a recess in the wall.

Bigman said, "I don't have a suit."

"You couldn't go out even if you had one. No one's allowed out without a special pass for a while."

"How come?"

Wilson yawned. "They've got a ship out there that's getting set to go," he looked at his watch, "in about twelve minutes. Maybe the heat will be off after it's gone. I don't know the story on it."

The sentry rocked on the balls of his feet and watched the last of the beer drain down Bigman's throat. He said, "Say, did you get the beer at Patsy's Port Bar? Is it crowded?"

"It's empty. Listen, tell you what. It'll take you fifteen seconds to get in there and have one. I've got nothing to do. I'll stay right here and make sure nothing happens while you're gone."

Wilson looked longingly in the direction of the Port Bar. "I better not."

"It's up to you."

Neither one of them, apparently, was conscious of the figure that drifted past behind them along the corridor and into the recess where the space-locks huge door barred the way to the surface.

Wilson's feet took him a few steps toward the Bar, as though they were dragging the rest of him. Then he said, "Nah! I better not."

\* \* \*

*Ten minutes to zero time.*

It had been Lucky Starr's idea. He had been in Con-way's home office the day the news arrived that

the T.S.S. *Waltham Zachary* had been gutted by pirates, its cargo gone, its officers frozen corpses in space and most of the men captives. The ship itself had put up a pitifully futile fight and had been too damaged to be worth the pirate's salvage. They had taken everything movable though, the instruments of course, and even the motors.

Lucky said, "It's the asteroid belt that's the enemy. One hundred thousand rocks."

"More than that." Conway spat out his cigarette. "But what can we do? Ever since the Terrestrial Empire has been a going concern, the asteroids have been more than we could handle. A dozen times we've gone in there to clean out nests of them, and each time we've left enough to breed the trouble again. Twenty-five years ago, when--"

The white-haired scientist stopped short. Twenty-five years ago Lucky's parents had been killed in space and he himself, a little boy, had been cast adrift.

Lucky's calm brown eyes showed no emotion. He said, "The trouble is we don't even know where all the asteroids are."

"Naturally not. It would take a hundred ships a hundred years to get the necessary information from the sizable asteroids. And even then the pull of Jupiter would be forever changing asteroidal orbits here and there."

"We might still try. If we sent out one ship, the pirates might not know it was an impossible job and fear the consequences of a real mapping. If the word got out that we had started a mapping survey the ship would be attacked."

"And then what?"

"Suppose we sent out an automatic ship, completely equipped, but with no human personnel."

"It would be an expensive thing to do."

"It might be worth it. Suppose we equipped it with lifeboats automatically designed to leave the ship when its instruments recorded the energy pattern of an approaching hyperatomic motor. What do you suppose the pirates would do?"

"Shoot the lifeboats into metal drift, board the ship, and take it to their base."

"Or one of their bases. Right. And if they see the lifeboats try to get away, they won't be surprised at finding no crew aboard. After all, it would be an unarmed survey ship. You wouldn't expect the crew to attempt resistance."

"Well, what are you getting at?"

"Suppose further that the ship is wired to explode once its temperature is raised to more than twenty degrees absolute, as it certainly would if it were brought into an asteroid hangar."

"You're proposing a booby trap, then?"

"A gigantic one. It would blow an asteroid apart. It might destroy dozens of pirate ships. Furthermore, the observatories at Ceres, Vesta, Juno, or Pallas might pick up the flash. Then, if we could locate surviving pirates, we might get information that would be very useful indeed."

"I see."

And so they started work on the *Atlas*.

\* \* \*

The shadowy figure in the recess leading to the Moon's surface worked with sure quickness. The sealed controls of the air-lock gave under the needle beam of a micro-heatgun. The shielding metal disc swung open. Busy, black-gloved fingers flew for a moment. Then the disc was replaced and fused tightly back by a wider and cooler beam from the same heatgun.

The cave door of the lock yawned. The alarm that rang routinely whenever it did so was silent this time, its circuits behind the tampered disc disarranged. The figure entered the lock and the door closed.



behind him. Before he opened the surface door that faced out into the vacuum, he unrolled the plastic he carried under his arm. He scrambled into it, the material covering him wholly and clinging to him, broken only by a strip of clear silicone plastic across his eyes. A small cylinder of liquid oxygen was clamped to a short hose that led to the headpiece and was hooked on to the belt. It was a semi-space-suit, designed for the quick trip across an airless surface, not guaranteed to be serviceable for stretches of more than half an hour.

\* \* \*

Bert Wilson, startled, swiveled his head. "Did you hear that?"

Bigman gaped at the sentry. "I didn't hear anything."

"I could swear it was a lock door closing. There isn't any alarm, though."

"Is there supposed to be?"

"Sure. You've got to know when one door is open. It's a bell where there's air and a light where there isn't. Otherwise someone is liable to open the other door and blow all the air out of a ship's corridor."

"All right. If there's no alarm, there's nothing to worry about."

"I'm not so sure." With flat leaps, each one covering twenty feet in the Moon's baby gravity, the sentry passed up the corridor to the air-lock recess. He stopped at a wall panel on the way and activated three separate banks of ceiling Floressesoes, turning the area into a noonday of light.

Bigman followed, leaping clumsily and in perpetual danger of overbalancing into a slow nosed landing.

Wilson had his blaster out. He inspected the door, then turned to look up the corridor again. "Are you sure you didn't hear anything?"

"Nothing," said Bigman. "Of course, I wasn't listening."

*Five minutes to zero time.*

Pumice kicked up as the space-suited figure moved slow-motion toward the *Atlas*. The space-ship glittered in the Earthlight, but on the Moon's airless surface the light did not carry even an inch into the shadow of the ridge that hemmed in the port.

In three long leaps the figure moved across the lighted portion and into the pitchy shadow of the ship itself.

He moved up the ladder hand over hand, flinging himself into an upward drift that carried him to the rungs at a time. He came to the ship's air-lock. A moment at the controls and it yawned open, then closed.

The *Atlas* had a passenger. One passenger!

\* \* \*

The sentry stood before the corridor air-lock and considered its appearance dubiously.

Bigman was rattling on. He said, "I been here nearly a week. I'm supposed to follow my side-kick around and make sure he doesn't get into trouble. How's that for a space wrangler like me. I haven't had a chance to get away--"

The anguished sentry said, "Give it a rest, friend. Look, you're a nice kid and all that, but let's have it some other time."

For a moment he stared at the control seal. "That's funny," he said.

Bigman was swelling ominously. His little face had reddened. He seized the sentry by the elbow

and swung him about, almost overbalancing himself as he did so.

"Hey, bud, who're you calling a kid?"

"Look, go away!"

"Just a minute. Let's get something straight. Don't think I let myself get pushed around because I'm not as tall as the next fellow. Put 'em up. Go ahead. Get your fists up or I'll splatter your nose all over your face."

He was sparring and slipping about.

Wilson looked at him with astonishment. "What's got into you? Stop being foolish."

"Scared?"

"I can't fight on duty. Besides, I didn't mean to hurt your feelings. I've just got a job to do and haven't got any time for you."

Bigman lowered his fists. "Hey, I guess the ship's taking off."

There was no sound, of course, since sound would not travel through a vacuum, but the ground under their feet vibrated softly in response to the hammer blows of a rocket exhaust lifting a ship off a planet.

"That's it, all right." Wilson's forehead creased. "Guess there's no use making a report. It's too late anyway." He had forgotten about the control seal.

\* \* \*

*Zero time!*

The ceramic-lined exhaust pit yawned under the *Atlas* and the main rockets blasted their fury into it. Slowly and majestically the ship lifted and moved upward ponderously. Its speed increased. It pierced the black sky, shrinking until it was only a star among stars, and then it was gone.

\* \* \*

Dr. Henree looked at his watch for the fifth time and said, "Well, it's gone. It must be gone now." He pointed with the stem of his pipe to the dial.

Conway said, "Let's check with the port authorities."

Five seconds later they were looking at the empty space-port on the visiscreen. The exhaust port was still open. Even in the near-ultimate frigidity of the Moon's dark side it was still steaming.

Conway shook his head. "It was a beautiful ship."

"Still is."

"I think of it in the past. In a few days it will be a rain of molten metal. It's a doomed ship."

"Let's hope that there's a pirate base somewhere that's also doomed."

Henree nodded somberly.

They both turned as the door opened. It was only Bigman.

He broke into a grin. "Oh, boy, it was sure nice coming in to Luna City. You could feel the pound going back on with each step you took." He stamped his feet and hopped two or three times. "See," he said, "you try that out where I was and you hit the ceiling and look like one big fool."

Conway frowned. "Where's Lucky?"

Bigman said, "I know where he is. I know where he is every minute. Say, the *Atlas* has just taken off."

"I know that," said Conway. "And where is Lucky?"

"On the *Atlas*, of course. Where do you think he'd be?"

---

## Chapter 2

### Vermin Of Space

Dr. Henree dropped his pipe and it bounced on the linolite flooring. He paid it no attention.

"What!"

Conway reddened and his face stood out, plumply pink, against his snowy hair. "Is this a joke?"

"No. He got on five minutes before it blasted. I talked to the sentry, guy called Wilson, and kept him from interfering. I had to pick a fight with the fellow and I would have given him the old bing bango," he demonstrated the one-two punch with quick, hard blows at the atmosphere, "but he backed off."

"You let him? You didn't warn us?"

"How could I? I've got to do what Lucky says. He said he had to get on at the last minute and without anyone knowing, or you and Dr. Henree would have stopped him."

Conway groaned. "He did it. By space, Gus, I should have known better than to trust that pint-sized Martian. Bigman, you fool! You know that ship's a booby trap."

"Sure. Lucky knows it too. He says not to send out ships after him or things will be ruined."

"They will, will they? There'll be men after him within the hour just the same."

Henree clutched his friend's sleeve. "Maybe not, Hector. We don't know what he's planning to do but we can trust him to scramble out safely whatever it is. Let's not interfere."

Conway fell back, trembling with anger and anxiety.

Bigman said, "He says we're to meet him on Ceres, and also, Dr. Conway, he says you're to control your temper."

"You-" began Conway, and Bigman left the room in a hurry.

\* \* \*

The orbit of Mars lay behind and the sun was a shrunken thing.

Lucky Starr loved the silence of space. Since he had graduated and joined the Council of Science, space had been his home, rather than any planetary surface. And the *Atlas* was a comfortable ship. It had been provisioned for a full crew with only so much omitted as might be explained by consumption before reaching the asteroids. In every way the *Atlas* was intended to look as though, until the moment of the pirates' appearance, it had been fully manned.

So Lucky ate Syntho-steak from the yeast beds of Venus, Martian pastry, and boneless chicken from Earth.

I'll get fat, he thought, and watched the skies.

He was close enough to make out the larger asteroids. There was Ceres, the largest of all, nearly five hundred miles in diameter. Vesta was on the other side of the sun, but Juno and Pallas were in sight.

If he were to use the ship's telescope, he would have found more, thousands more, maybe tens of thousands. There was no end to them.

Once it had been thought that there had been a planet between Mars and Jupiter and that geology

ages earlier it had exploded into fragments, but that wasn't so. It was Jupiter that was the villain. Its giant gravitational influence had disrupted space for hundreds of millions of miles about it in the eons when the Solar System was being formed. The cosmic gravel between itself and Mars could never coalesce into a single planet with Jupiter pulling and pulling. Instead it coalesced into myriads of little worlds.

There were the four largest, each a hundred or more miles in diameter. There were fifteen hundred more that were ten and a hundred miles in diameter. After that there were thousands (no one knew exactly how many) that were between one and ten miles in diameter and tens of thousands that were less than a mile in diameter but still as large or larger than the Great Pyramid.

They were so plentiful that astronomers called them "the vermin of space."

The asteroids were scattered over the entire region between Mars and Jupiter, each whirling in its own orbit. No other planetary system known to man in all the Galaxy had such an asteroid belt.

In a sense it was good. The asteroids had formed steppingstones out toward the major planets. In another sense it was bad. Any criminal who could escape to the asteroids was safe from capture by all but the most improbable chance. No police force could search every one of those flying mountains.

The smaller asteroids were no man's land. There were well-manned astronomical observatories on the largest, notably on Ceres. There were beryllium mines on Pallas, while Vesta and Juno were important fueling stations. But that still left fifty thousand sizable asteroids over which the Terrestrial Empire had no control whatever. A few were large enough to harbor fleets. Some were too small for more than a single speed-cruiser with additional space, perhaps, for a six-month supply of fuel, food, and water.

And it was impossible to map them. Even in the ancient, preatomic times, before space travel when only fifteen hundred or so were known, and those the largest, mapping had been impossible. Their orbits had been carefully calculated via telescopic observation and still asteroids were forever being "lost," then "found" again.

\* \* \*

Lucky snapped out of his reverie. The sensitive Ergometer was picking up pulsations from the outer reaches. He was at the control board in a step.

The steady energy outpourings of the sun, whether direct or by way of the relatively tiny reflected dribbles from the planets, were canceled out on the meter. What was coming in now were the characteristically intermittent energy pulses of a hyperatomic motor.

Lucky threw in the Ergograph connection and the energy pattern traced itself out in a series of lines. He followed the graphed paper as it emerged and his jaw muscles hardened.

There had always been a chance that the *Atlas* might meet an ordinary trading ship or passenger liner, but the energy pattern was none of that. The approaching ship had motors of advanced design and different from any of the Terrestrial fleet.

Five minutes passed before he had enough spread of measurement to be able to calculate the distance and direction of the energy source.

He adjusted the visiplat for telescopic viewing and the star field speckled enormously. Carefully he searched among the infinitely silent, infinitely distant, infinitely motionless stars until a flicker of movement caught his eyes and the Ergometer's reading dials lined up at multiple zero.

It was a pirate. No doubt! He could make out its outlines by the half that glittered in the sun and by the port lights in the shaded half. It was a thin, graceful vessel, having the look of speed and maneuverability. It had an alien look about it, too.

Sirian design, thought Lucky.

He watched the ship grow slowly larger on the screen. Was it such a ship that his father and mother watched on the last day of their lives?

---

\* \* \*

He scarcely remembered his father and mother, but he had seen pictures of them and had heard endless stories about Lawrence and Barbara Starr from Henree and Conway. They had been inseparable, the tall, grave Gus Henree, the choleric, persevering Hector Conway, and the quick laughing Larry Starr. They had gone to school together, graduated simultaneously, entered the Council as one and done all their assignments as a team.

And then Lawrence Starr had been promoted and assigned to a tour of duty on Venus. He, his wife and his four-year-old son were Venus-bound when the pirate ship attacked.

For years Lucky had unhappily imagined what that last hour upon the dying ship must have been like. First, the crippling of the main power drives at the stern of the ship while pirate and victim were still apart. Then the blasting of the air-locks and the boarding. The crew and passengers scrambling into space-suits against the loss of air when the air-locks caved in. The crew armed and waiting. The passengers huddling in the interior rooms without much hope. Women weeping. Children screaming.

His father wasn't among the hiders. His father was a Council member. He had been armed and fighting. Lucky was sure of that. He had one memory, a short one that had been burned into his mind. His father, a tall, strong man, was standing with blaster raised and face set in what must have been one of the few moments of cold rage in his life, as the door of the control room crashed inward in a cloud of black smoke. And his mother, face wet and smudged but clearly seen through the space-suit faceplate, was forcing him into a small lifeboat.

"Don't cry, David, it will be all right."

Those were the only words he remembered ever having heard his mother say. Then there was thunder behind him and he was pressed back against a wall.

They found him in the lifeboat two days later, when they followed its coldly automatic radio call for help.

The government had launched a tremendous campaign against the asteroid pirates immediately afterward and the Council had lent that drive every last ounce of their own effort. For the pirates turned out that to attack and kill key men of the Council of Science was bad business. Such asteroid hideouts as were located were blasted into dust, and the pirate menace was reduced to the mere flicker for twenty years.

But often Lucky wondered if they had ever located the particular pirate ship that had carried the men who had killed his parents. There was no way of telling.

And now the menace had revived in a less spectacular but far more dangerous fashion. Piracy wasn't a matter of individual jabs any longer. It bore the appearance of an organized attack on Terrestrial commerce. There was more to it. From the nature of the warfare carried on Lucky felt certain that one mind, one strategic direction, lay behind it. That one mind, he knew, he would have to find.

\* \* \*

He lifted his eyes to the Ergometer once more. The energy recordings were strong now. The other vessel was well within the distance at which space courtesy required routine messages of mutual identification. For that matter, it was well within the distance at which a pirate might have made its initial hostile move.

The floor shuddered under Lucky. It wasn't a blaster bolt from the other ship, but rather the recoil of a departing lifeboat. The energy pulses had become strong enough to activate their automatic controls.

Another shudder. And another. Five altogether.

He watched the oncoming ship closely. Often pirates shot up such lifeboats, partly out of the perverted fun of it and partly to prevent escapees from describing the vessel, assuming they had not done so already through the sub-ether.

This time, however, the ship ignored the lifeboats altogether. It approached within locking range. Its magnetic grapples shot out, clamped on the *Atlas's* hull, and the two vessels were suddenly welded together, their motions through space well matched.

Lucky waited.

He heard the air-lock open, then shut. He heard the clang of feet and the sound of helmets being undipped, then the sound of voices.

He didn't move.

A figure appeared in the door. Helmet and gauntlets had been removed, but the rest of the man was still swathed in ice-coated space-suit. Space-suits had a habit of doing that when one entered from the near-absolute zero of space into the warm moist air of the interior of a ship. The ice was beginning to melt.

The pirate caught sight of Lucky only when he was two full steps into the control room. He stopped, his face frozen in an almost comical expression of surprise. Lucky had time to note the sparse black hair, the long nose, and the dead white scar that ran from nostril to canine tooth splitting the upper lip into two unequal parts.

Lucky bore the pirate's astonished scrutiny calmly. He had no fear of recognition. Councilmen on active duty always worked without publicity with the very thought that a too-well-known face would diminish their usefulness. His own father's face had appeared over the sub-ether only after his death. With fleeting bitterness Lucky thought that perhaps better publicity during life might have prevented the pirate attack. But that was silly, he knew. By the time the pirates had seen Lawrence Starr the attack had proceeded too far to be stopped.

Lucky said, "I've got a blaster. I'll use it only if you reach for yours. Don't move."

The pirate had opened his mouth. He closed it again.

Lucky said, "If you want to call the rest, go ahead."

The pirate stared suspiciously, then, eyes firmly on Lucky's blaster, yelled, "Blinking Space there's a ripper with a gat here."

There was laughter at that, and a voice shouted, "Quiet!"

Another man stepped into the room. "Step aside, Dingo," he said.

His space-suit was off entirely and he was an incongruous sight aboard ship. His clothing might have come out of the most fashionable tailor shop in International City, and would have suited better a dinner party back on Earth. His shirt had a silken look you got only out of the best plastex. Its iridescence was subtle rather than garish, and his tight-ankled breeches blended in so well that, but for the ornamented belt, it would have seemed one garment. He wore a wristband that matched his belt and a fluffy, sky-blue neck sash. His crisp brown hair was curly and looked as though it received frequent attention.

He was half a head shorter than Lucky, but from the way he carried himself the young Councilman could see that any assumption of softness he might make on the basis of the man's dude costume would be quite wrong.

The newcomer said pleasantly, "Anton is my name. Would you put down your gun?"

Lucky said, "And be shot?"

"You may be shot eventually, but not at the moment. I would like to question you first."

Lucky held fast.

---

Anton said, "I keep my word." A tiny flush appeared on his cheekbones. "It is my only virtue and men count virtue, but I hold fast to it."

Lucky put down his blaster and Anton picked it up. He handed it to the other pirate.

"Put it away, Dingo, and get out of here." He turned to Lucky. "The other passengers got away in the lifeboats? Right?"

Lucky said, "That's an obvious trap, Anton-"

"Captain Anton, *please*." He smiled, but his nostrils flared.

"Well, then, it's a trap, Captain Anton. It was obvious that you knew there were no passengers or crew on this ship. You knew it long before you boarded."

"Indeed? How do you make that out?"

"You approached the ship without signaling and without a warning shot. You made no particular speed. You ignored the lifeboats when they shot out. Your men entered the ship carelessly, as though they expected no resistance. The man who first found me entered this room with his blaster well bolstered. The conclusion follows."

"Very good. And what are you doing on a ship without crew or passengers?"

Lucky said grimly, "I came to see you, Captain Anton."

---

# Chapter 3

## Duel In Word

Anton's expression did not change. "And now you see me.

"But not privately, Captain." Lucky's lips thinned and closed with great deliberation.

Anton looked quickly about. A dozen of his men in every stage of space-suit undress had crowded into the room, watching and listening with gaping interest.

He reddened slightly. His voice rose. "Get on your business, scum. I want a complete report on the ship. And keep your weapons ready. There may be more men on board and if anyone else gets caught as Dingo did, he'll be tossed out an air-lock."

There was slow, shuffling motion outward.

Anton's voice was a sudden scream. "Quickly! Quickly!" One snaking gesture, and a blaster was in his hand. "I'll count three and shoot. One... two..."

They were gone.

He faced Lucky again. His eyes glittered and his breath came and went quickly through pinched white nostrils.

"Discipline is a great thing," he breathed. "They must fear me. They must fear me more than the fear capture by the Terrestrial Navy. Then a ship is one mind and one arm. *My* mind and arm."

Yes, thought Lucky, one mind and one arm, but whose? Yours?

Anton's smile had returned, boyish, friendly, and open. "Now tell me what you want."

Lucky jerked a thumb toward the other's blaster, still drawn and ready. He matched the other's smile. "Do you intend shooting? If so, get it over with."

Anton was shaken. "Space! You're a cool one. I'll shoot when I please. I like it this way. What's your name?" The blaster held on its line with deadly steadiness.

"Williams, Captain."

"You're a tall man, Williams. You look strong. And yet here I sit and with just a pressure of my thumb you're dead. I think it's very instructive. Two men and one blaster is the whole secret of power. Did you ever think of power, Williams?"

"Sometimes."

"It's the only meaning to life, don't you think?"

"Maybe."

"I see you're anxious to do business. Let's begin. Why are you here?"

"I've heard of pirates."

"We're the men of the asteroids, Williams. No other name."

"That suits me. I've come to join the men of the asteroids."

"You flatter us, but my thumb is still on the blaster contact. Why do you want to join?"

"Life is closed on Earth, Captain. A man like myself could settle down to be an accountant or an engineer. I might even run a factory or sit behind a desk and vote at stockholders' meetings. It doesn't matter. Whatever it is, it would be routine. I would know my life from beginning to end. There would be no adventure, no uncertainty."

"You're a philosopher, Williams. Go on."



"There are the colonies, but I'm not attracted by a life as a farm boy on Mars or as a vat tender on Venus. ~~What does attract me is the Me on the asteroids. You live hard and dangerously. A man can rise to "power as you have. As you say, power gives meaning to life."~~

"So you stow away on an empty ship?"

"I didn't know it was empty. I had to stow away somewhere. Legitimate space passage comes high and passports to the asteroids aren't being handed out these days. I knew this ship was part of a mapping expedition. The word had got around. It was headed for the asteroids. So I waited till just before it blasted off. That's when everybody would be busy getting ready for take-off and yet the airlocks would still be open. I had a pal take a sentry out of circulation.

"I figured we'd stop at Ceres. It would be bound to be Prime Base for any asteroid expedition. Once there, it seemed to me I could get off without trouble. The crew would be astronomers and mathematicians. Snatch off their glasses and they'd be blind. Point a blaster at them and they'd die in fright. Once on Ceres I'd contact the pi-The men of the asteroids, somehow. Simple."

"Only you got a surprise when you boarded ship? Is that it?" asked Anton.

"I'll say. No one aboard and before I could get it straight in my mind that there *wasn't* anyone aboard, it blasted off."

"What's it all about, Williams? How do you figure it?" "I don't. It beats me."

"Well, let's see if we can find out. You and I together." He gestured with his blaster and said sharply, "Come on".

The pirate chief led the way out of the control room into the long central corridor of the ship. A group of men came out of a door up ahead. They rumbled short comments at one another and still fell into silence when they caught Anton's eyes.

Anton said, "Come here."

They approached. One wiped a grizzled mustache with the back of his hand and said, "No one else on board this ship, Captain."

"All right. What do you think of the ship?"

There were four of them. The number increased as more men joined the group.

Anton's voice grew edgy. "What do any of you think of the ship?"

Dingo pushed his way forward. He had got rid of his space-suit and Lucky could see him as a man. It was not altogether a pleasant sight. He was broad and heavy and his arms were slightly bowed and they hung loosely from bulging shoulders. There were tufts of dark hair on the back of his fingers and the scar on his upper lip twitched. His eyes glared at Lucky.

He said, "I don't like it."

"You don't like the ship?" Anton asked sharply.

Dingo hesitated. He straightened his arms, threw back his shoulders. "It stinks."

"Why? Why do you say that?"

"I could take it apart with a can opener. Ask the rest and see if they don't agree with me. This craft is put together with toothpicks. It wouldn't hold together for three months."

There were murmurs of agreement. The man with the gray mustache said, "Beg your pardon, Captain, but the wiring is taped in place. It's a two-bit job. The insulation is almost burnt through already."

"All the welding was done in a real hurry," said another. "The seams stand out like that." He held out a thick and dirty thumb.

"What about repairs?" asked Anton.

Dingo said, "It would take a year and a Sunday. It isn't worth it. Anyway, we couldn't do it here. We'd have to take it to one of the rocks."

Anton turned to Lucky, explaining suavely, "We always refer to the asteroids as 'rocks,' you

understand."

Lucky nodded.

Anton said, "Apparently my men feel that they wouldn't care to ride this ship. Why do you suppose the Earth government would send out an empty ship and such a jerry-built job to boot?"

"It keeps getting more and more confusing," said Lucky.

"Let's complete our investigation, then."

Anton walked first. Lucky followed closely. The men tagged behind silently. The back of Lucky's neck prickled. Anton's back was straight and fearless, as though he expected no attack from Lucky. He might well feel so. Ten armed men were on Lucky's heels.

They glanced through the small rooms, each designed for utmost economy in space. There was the computation room, the small observatory, the photographic laboratory, the galley and the bunk room.

They slipped down to the lower level through a narrow curving tube within which the pseudo-gravity field was neutralized so that either direction could be "up" or "down" at will. Lucky was motioned down first, Anton following so closely that Lucky barely had time to scramble out of the way (his legs buckling slightly with the sudden access of weight) before the pirate chief was upon him. Hard, heavy space-boots missed his face by inches.

Lucky regained his balance and whirled angrily, but Anton was standing there smiling pleasantly. His blaster lined up straight and true at Lucky's heart.

"A thousand apologies," he said. "Fortunately you are quite agile."

"Yes," muttered Lucky.

On the lower level were the engine room and the power plant; the empty berths where the lifeboats had been. There were the fuels store, the food and water stores, the air fresheners, and the atomic shielding.

Anton murmured, "Well, what do you think of it all? Shoddy, perhaps, but I see nothing out of order."

"It's hard to tell like this," said Lucky.

"But you must have lived on this ship for days."

"Sure, but I didn't spend time looking it over. I just waited for it to get somewhere."

"I see. Well, back to upper level."

Lucky was first "down" the travel tube again. This time he landed lightly and sprang six feet to one side with the grace of a cat.

Seconds passed before Anton popped out of the tube. "Jumpy?" he asked.

Lucky flushed.

One by one the pirates appeared. Anton did not wait for all of them, but started down the corridor again.

"You know," he said, "you'd think we'd been all over this ship. Most people would say so. Wouldn't you say so?"

"No," said Lucky calmly, "I wouldn't. We haven't been in the washroom."

Anton scowled and for more than just a moment the pleasantness was gone from his face, and on his forehead a tight, white anger flashed in its place.

Then it passed. He adjusted a stray lock of hair on his head, then regarded the back of his hand with interest. "Well, let's look there."

Several of the men whistled and the rest exclaimed in a variety of ways when the appropriate door clicked open.

"Very nice," murmured Anton. "Very nice. Luxurious, I would say."

It was! There was no question of that. There were separate stall showers, three of them, with the plumbing arranged for sudsing water (hike-warm) and rinsing water (hot or cold). There were also ha-

a dozen washbowls in ivory-chrome, with shampoo stands, hair driers and needle-jet skin stimulators. Nothing that was necessary was missing.

"There's certainly nothing shoddy about this," said Anton. "It's like a show on the sub-etherics, eh Williams? What do you make of this?"

"I'm confused."

Anton's smile vanished like the fleeting flash of a speeding space-ship across a visiplat. "I'm not Dingo, come in here."

The pirate chief said to Lucky, "It's a simple problem, you. We have a ship here with no one aboard, thrown together in the cheapest possible way, as though it were done in a hurry, but with a washroom that is the last word. Why? I think it's just in order to have as many pipes as possible *in* the washroom. And why that? So that we'd never suspect that one or two of them were dummies... Dingo, which pipe is it?"

Dingo kicked one.

"Well, don't kick it, you misbegotten fool. Take it apart."

Dingo did so, a micro-heatgun flashing briefly. He yanked out wires.

"What's that, Williams?" demanded Anton.

"Wires," said Lucky briefly.

"I know that, you lump." He was suddenly furious. "What else? I'll tell *you* what else. Those wires are set to explode every ounce of the atomite on board ship as soon as we take the ship back to base."

Lucky jumped. "How can you tell that?"

"You're surprised? You didn't know this was one big trap? You didn't know we were supposed to take this back to base for repairs? You didn't know we were supposed to explode ourselves and the base, too, into hot dust? Why, you're here as the bait to make sure we were-properly fooled. Only I'm not a fool!"

His men were crowding close. Dingo licked his lips.

With a snap Anton brought up his blaster and there was no mercy, no dream of mercy, in his eyes.

"Wait! Great Galaxy, wait! I know nothing about this. You have no right to shoot me without cause." He tensed for a jump, one last fight before death.

"No right!" Anton, eyes glaring, lowered his blaster suddenly. "How dare you say no right. I have all rights on this ship."

"You can't kill a good man. The men of the asteroids need good men. Don't throw one away for nothing."

A sudden, unexpected murmur came from some of the pirates.

A voice said, "He's got guts, Cap'n. Maybe we could use-"

It died away as Anton turned.

He turned back. "What makes you a good man, Williams? Answer that and I'll consider."

"I'll hold my own against anyone here. Bare fists or any weapon."

"So?" Anton's teeth bared themselves. "You hear that, men?"

There was an affirmative roar.

"It's your challenge, Williams. Any weapon. Good! Come out of this alive and you won't be shot. You'll be considered for membership in my crew."

"I have your word, Captain?"

"You have my word, and I never break my word. The crew hears me. *If* you come out of this alive"

"Whom do I fight?" demanded Lucky.

"Dingo here. A good man. Anyone who can beat him is a *very* good man."

Lucky measured the huge lump of gristle and sinew standing before him, its little eyes glittering with anticipation, and glumly agreed with the captain.

But he said firmly, "What weapons? Or is it bare fists?"

"Weapons! ~~Push-tubes, to be exact. Push-tubes in open space.~~"

---

For a moment Lucky found it difficult to maintain an appropriate stolidity.

Anton smiled. "Are you afraid it won't be a proper test for you? Don't be. Dingo is the best man with a push-gun in our entire fleet."

Lucky's heart plummeted. A push-gun duel required an expert. Notoriously so! Played as he had played it in college days, it was a sport. Fought by professionals, it was deadly!

And he was no professional!

---

# Chapter 4

## Duel In Deed

Pirates crowded the outer skin of the *Atlas* and of their own Sirian-designed ship. Some were standing, held by the magnetic field of their boots. Others had cast themselves loose for better viewing, maintaining their place by means of a short magnetic cable attached to the ship's hull.

Fifty miles apart two metal-foil goal posts had been set. Not more than three feet square in the collapsed state aboard ship, they opened into a hundred feet either way of thin-beaten beryllium magnesium sheets. Undimmed and undamaged in the great emptiness of space, they were set spinning and the flickering reflections of the sun on their gleaming surfaces sent beams that were visible for miles.

"You know the rules." Anton's voice was loud in Lucky's ears, and presumably in Dingo's ears as well.

Lucky could make out the other's space-suited shape as a sunlit speck half a mile away. The lifeboat that had brought them here was racing away now, back toward the pirate ship.

"You know the rules," said Anton's voice. "The one who gets pushed back to his own goal post is the loser. If neither gets pushed back, the one whose push-gun expires first is the loser. No time limit. No off-side. You have five minutes to get set. The push-gun can't be used till the word is given."

No off-side, thought Lucky. That was the giveaway. Push duels as a legal sport could not take place more than a hundred miles from an asteroid at least fifty miles in diameter. This would place a definite, though small, gravitational pull on the players. It would not be enough to affect mobility. It would be enough, however, to rescue a contestant who found himself miles out in space with an expired push-gun. Even if not picked up by the rescue boat he had only to remain quiet and in a matter of hours or, at most, one or two days, he would drift back to the asteroid's surface.

Here, on the other hand, there was no sizable asteroid within hundreds of thousands of miles. A real push would continue indefinitely. It would end, as likely as not, in the sun, long after the unlucky contestant had smothered to death when his oxygen gave out. Under such conditions it was usually understood that, when one contestant or another passed outside certain set limits, time was called until their return.

Saying "no off-side" was saying "to the death."

Anton's voice came clear and sharp across the miles of space between himself and the radio receiver in Lucky's helmet. He said, "Two minutes to go. Adjust body signals."

Lucky brought his hand up and closed the switch set into his chest. The colored metal foil which had earlier been magnet-set into his helmet was spinning. It was a miniature goal post. Dingo's figure a moment before merely a dim dot, now sprang into flickering ruddy hue.

His own signal, Lucky knew, was a flashing green. And the goal posts were pure white.

Even now a fraction of Lucky's mind was far away. He had tried to make one objection at the very beginning. He had said, "Look, this all suits me, you understand. But while we're fooling around, a government patrol ship might-"

Anton barked contemptuously, "Forget it. No patrol ship would have the guts to get this far in the rocks. We've a hundred ships within call, a thousand rocks to hold us if we had to make a getaway."

Get into your suit."

A hundred ships! A thousand rocks! If true, the pirates had never yet shown their full hand. What was going on?

"One minute left!" said Anton's voice through space.

Grimly Lucky brought up his two push-guns. They were L-shaped objects connected by spring-gummed-fabric tubing to the doughnutlike gas cylinders (containing carbon dioxide liquid under great pressure) that had been adjusted about his waist. In the old days the connecting tubing had been metal mesh. But that, though stronger, had also been more massive and had added to the momentum and inertia of the guns. In push duels rapid aiming and firing was essential. Once a fluorinated silicon had been invented which could remain a flexible gum at space temperatures and yet not become tacky in the direct rays of the sun, the lighter tubing material was universally used.

"Fire when ready!" cried Anton.

One of Dingo's push-guns triggered for an instant. The liquid carbon dioxide of his gas cylinder bubbled into violent gas and spurted out through the push-gun's needlelike orifice. The gas froze into a line of tiny crystals within six inches of its point of emission. Even in the half second allowed for release a line of crystals, miles long, had been formed. As they pushed out one way, Dingo was pushed in the other. It was a spaceship and its rocket blast in miniature.

Three times the "crystal line" flashed and faded in the distance. It pointed into space directly away from Lucky, and each time Dingo gained speed toward Lucky. The actual state of affairs was deceptive. The only change visible to the eye was the slow brightening of Dingo's suit signal, but Lucky knew that the distance between them was closing with hurtling velocity.

What Lucky did not know was the proper strategy to expect; the appropriate defense. He waited to let the other's offensive moves unfold.

Dingo was large enough now to see as a humanoid shape with head and four limbs. He was passing to one side, and making no move to adjust his aim. He seemed content to bear far to Lucky's left.

Lucky still waited. The chorus of confused cries that rang in his helmet had died down. They came from the open transmitters of the audience. Though these were too far away to see the contestants, they could still follow the passage of the body signals and the flashes of the carbon dioxide stream. They were expecting something, Lucky thought.

It came suddenly.

A blast of carbon dioxide, then another appeared to Dingo's right, and his line of flight veered toward the young Councilman's position. Lucky brought his push-gun up, ready to flash downward and avoid close quarters. The safest strategy, he thought, was to do just that, and to move as slowly and a little as possible otherwise, in order to conserve carbon dioxide.

But Dingo's flight did not continue toward Lucky. He fired straight ahead of himself, a long streak and began to recede. Lucky watched him, and only too late the streak of light met his eyes.

The line of carbon dioxide that Dingo had last fired traveled forward, yes, but he had been moving leftward at the time and so it did likewise. The two motions together moved it directly toward Lucky and it struck his left shoulder bull's-eye.

To Lucky it felt like a sharp blow pounding him. The crystals were tiny, but they extended for miles and they were traveling at miles per second. They all hit his suit in the space of what seemed a fraction of an eyelid's flicker. Lucky's suit trembled and the roar of the audience was in his ear.

"You got him, Dingo!"

"What a blast!"

"Straight toward goal post. Look at him!"

"It was beautiful. Beautiful!"

"Look at the joker spin!"

Underneath that there were murmurs that seemed, somehow, less exuberant.

Lucky was spinning or, rather, it seemed to his eyes that the heavens and all the stars in it were spinning. Across the face plate of his helmet the stars were white streaks, as though they were sparks of trillions of carbon dioxide crystals themselves.

He could see nothing but the numerous blurs. For a moment it was as though the blow had knocked the power of thinking out of him.

A blow in the midriff and one in the back sent him, still spinning, further on his hurtling way through space.

He had to do something or Dingo would make a football of him from one end of the Solar System to the other. The first thing was to stop the spin and get his bearings. He was tumbling diagonally, left shoulder over right hip. He pointed the push-gun in the direction counter to that twist, and in lightning releases pumped out streams of carbon dioxide.

The stars slowed until their turning was a stately march that left them sharply defined points. The sky became the familiar sky of space.

One star flickered and was too bright. Lucky knew it to be his own goal post. Almost diametrically opposed was the angry red of Dingo's body signal. Lucky could not fling himself backward beyond the goal post or the duel would be over and he would have lost. Beyond the goal post and within a mile it was the standard rule for a goal ending. Nor, on the other hand, could he afford to get closer to his opponent.

He brought his push-gun straight up over his head, closed contact, and held it so. He counted a full minute before he released contact, and through all the sixty seconds he felt the pressure against the top of his helmet as he accelerated downward.

It was a desperate maneuver, for he threw away a half hour's supply of gas in that one minute.

Dingo, in outrage, yelled hoarsely, "You flumstered coward! You yellow mugger!"

The cries of the audience also rose to a crescendo.

"Look at him run."

"He got past Dingo. Dingo, get him."

"Hey, Williams. Put up a fight."

Lucky saw the crimson blur of his enemy again.

He had to keep on the move. There was nothing else he could do. Dingo was an expert and could hit a one-inch meteorite as it flashed by. He himself, Lucky thought ruefully, would do well to hit Ceres at a mile.

He used his push-guns alternately. To the left, to the right; then quickly, to the right, to the left and to the right again.

It made no difference. It was as though Dingo could foretell his moves, cut across the corner and move in inexorably.

Lucky felt the perspiration beading out upon his forehead, and suddenly he was aware of the silence. He could not remember the exact moment it had come, but it had come like the breaking of a thread. One moment there had been the yells and laughter of the pirates, and the next moment only the dead silence of space where sound could never be heard.

Had he passed beyond range of the ships? Impossible! Suit radios, even the simplest type, would carry thousands of miles in space. He pushed the sensitivity dial on his chest to maximum.

"Captain Anton!"

But it was Dingo's rough voice that answered. "Don't yell. I hear you."

Lucky said, "Call time! There's something wrong with my radio."

Dingo was close enough to be made out as a human figure again. A flashing line of crystals and he was closer. Lucky moved away, but the pirate followed on his heels.

"Nothing wrong," said Dingo. "Just a gimmicked radio. I've been waiting. I've been waiting. ~~could have knocked you past goal long ago, but I've been waiting for the radio to go.~~ It's just a little transistor I gimmicked before you put on your suit. You can still talk to me, though. It'll still carry a mile or two. Or at least you can talk to me for a little while." He relished the joke and barked a little laughter.

Lucky said, "I don't get it."

Dingo's voice turned harshly cruel. "You caught me on the ship with my blaster in its holster. You trapped me there. You made me look like a fool. No one traps me and I don't let anyone make a fool out of me in front of the captain and live very long after that. I'm not goaling you for someone else to finish. I'm finishing you here! Myself!"

Dingo was much closer. Lucky could almost make out the face behind the thick glassite of the face plate.

Lucky abandoned attempts at bobbing and weaving. That would lead, he decided, to being consistently out-manuevered. He considered straight flight, pushing outward at increasing velocity as long as his gas held out.

But then afterward? And was he going to be content to die while running away?

He would have to fight back. He aimed the push-gun at Dingo, and Dingo wasn't there when the line of crystals passed through the spot where a moment before he *had* been. He tried again and again but Dingo was a flitting demon.

And then Lucky felt the hard impact of the other's push-gun blast and he was spinning again. Desperately he tried to come out of the spin and before he could do so, he felt the clanging force of another body's collision with his.

Dingo held his suit in tight embrace.

Helmet to helmet. Face plate to face plate. Lucky was staring at the white scar splitting Dingo's upper lip. It spread tightly as Dingo smiled.

"Hello, chum," he said. "Pleased to meet you."

For a moment Dingo floated away, or seemed to, as he loosened the grip of his arms. The pirate's thighs held firm about Lucky's knees, their apelike strength immobilizing him. Lucky's own whipcord muscles wrenched this way and that uselessly.

Dingo's partial retreat had only been designed to free his arms. One lifted high, push-gun held butt-first. It came down directly on the face plate and Lucky's head snapped back with the sudden shattering impact. The relentless arm swung up again, while the other curled about Lucky's neck.

"Hold your head still," the pirate snarled. "I'm finishing this."

Lucky knew that to be the literal truth unless he acted quickly. The glassite was strong and tough but it would hold out only so long against the battering of metal.

He brought up the heel of his gauntleted hand against Dingo's helmet, straightening his arm and pushing the pirate's head back. Dingo rocked his head to one side, disengaging Lucky's arm. He brought the butt of his push-gun down a second time.

Lucky dropped both push-guns, let them dangle from their connecting tubes, and with a sudden movement snatched at the connecting tubes of Dingo's guns. He threaded them between the fingers of his steel gloves. The muscles of his arms lumped and tightened painfully. His jaws clenched and he felt the blood creep to his temples.

Dingo, his mouth twisted in fierce joyful anticipation, disregarded everything but the upturned face of his victim behind the transparent face plate, contorted, as he thought, with fear. Once more the butt came down. A small cracking star appeared where the metal had struck.

Then something else gave and the universe seemed to go mad.

First one and, almost immediately afterward, the other of the connecting tubes of Dingo's twin



---

sample content of Lucky Starr and the Pirates of the Asteroids

- [download Before Nature: A Christian Spirituality](#)
- [download Small Earthquake in Chile.pdf](#)
- [Onshore and Offshore Wind Energy: An Introduction online](#)
- [download Trial by Fire \(Terminator: Salvation, Book 4\)](#)
- [read The Far Pavilions](#)
  
- <http://betsy.wesleychapelcomputerrepair.com/library/PhoneGap-Beginner-s-Guide.pdf>
- <http://patrickvincitore.com/?ebooks/Foods-of-Spain--Taste-of-Culture-.pdf>
- <http://paulczajak.com/?library/Onshore-and-Offshore-Wind-Energy--An-Introduction.pdf>
- <http://cambridgebrass.com/?freebooks/La-Idea-de-la-Fenomenolog--a.pdf>
- <http://econtact.webschaefer.com/?books/New-Media-New-Methods--The-Academic-Turn-from-Literacy-to-Electracy--New-Media-Theory-.pdf>