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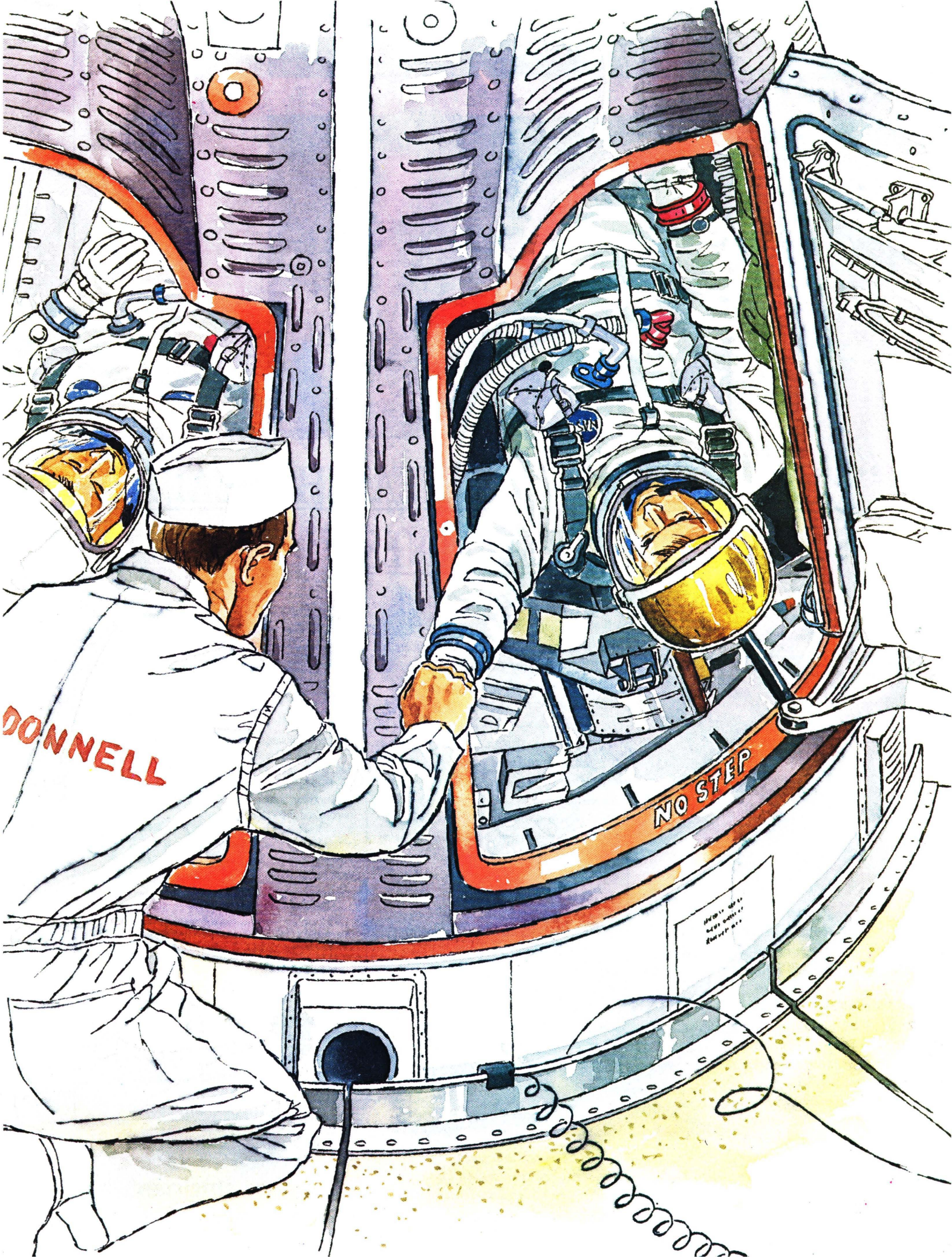
In space, Gemini astronaut Michael Collins takes a walk on the wild side (p. 42)


DONNELL
NO STEP

By Michael Collins

The hairy ride aboard Gemini 10, a 'bridge' on our way to the moon

During an orbital mission in 1966, the author and his fellow astronaut John Young felt richer than kings—but a lot more vulnerable

The little old ladies of Worcester, Massachusetts, who sew and glue pressure suits for the National Aeronautics and Space Administration (NASA) have been good to me. My custom-tailored outfit is about as comfortable as it can be. I slip into it, lock helmet and gloves in place and begin breathing 100-percent oxygen to start the process of purging nitrogen from my system. This is the day John Young and I have been anticipating ever since we were assigned to the Gemini 10 spaceflight six months ago. It's July 18, 1966—launch day.

John is the commander and I'm his copilot. This morning we stayed up until 4 making last-minute preparations, then slept until noon. Now, carrying our portable oxygen containers like attaché cases, we leave the ready room at Cape Kennedy and ride in a small van out to the launchpad. Here we enter the grillwork cage of an orange elevator that clatters up the side of the gantry. On top, people help shove us down inside our Gemini capsule, attach parachute harnesses, oxygen and radio connections, shake hands and reverently close the hatches.

It is a little before 3:30 P.M. In less than two hours, if all goes well, we will lift off the pad with a deafening roar on a four-day trip, during which we will try to do a little bit of everything: set a world altitude record, rendezvous with two orbiting Agena rockets, dock with one of them and locate the other one without radar. Best of all, I'm scheduled for two periods of Extravehicular Activity (EVA), including an attempt to retrieve two experimental packages, one from our spacecraft, the other from the second Agena.

"On top, people help us down inside our Gemini, attach equipment, shake hands and close the hatches."

Although John and I are alone in our cramped quarters aboard Gemini 10, we're not lonesome, for over the radio comes a continual chatter from people in the nearby blockhouse and from Mission Control in Houston. It is mostly technical stuff but it includes the welcome news that our first Agena target, which was launched about 100 minutes ago from a nearby pad, has made it safely into orbit.

Down below, our Titan stirs as its two engines swivel back and forth during a final check. We feel a little shudder in the cockpit and then all is still again. Finally comes the ten-second countdown and, clutching an emergency ejection ring between my legs in a death grip, I hold my breath and wait for ignition. There it is! A slight bump and I know we're on our way.

We jerk back and forth a bit as the engines a hundred feet below work to keep us balanced despite gusty winds and sloshing fuel tanks. I can see a tiny patch of blue sky out my window but there is no sensation of speed until a thin layer of cloud approaches. Then—pow!—we burst through it faster than my eye can follow. We really *are* moving out. I begin to feel heavier and heavier, and now a mild fore-and-aft vibration causes the instrument panel to go slightly out of focus. At 50 seconds, we pass the altitude after which we can no longer use our ejection seats and I let go of the ring, my fingers tingling. Noise and vibration smooth out abruptly as we reach supersonic speed and thinner air.

In a minute and 20 seconds, we have accelerated from zero to 1,000 miles per hour and have climbed from sea level to 40,000 feet. As the first-stage tanks empty, we are up over five Gs, which means the pressure we are feeling is five times the normal weight of gravity. Suddenly, as the power shifts to the second-stage engine, I am flung forward in my straps, and the window changes from black to red to yellow. We find out later that the second-stage engine has blasted the

Illustrations by Pierre Mion

"The second-stage engine has blasted the top of the first stage, causing the oxidizer tank to explode."

top of the first stage, causing an oxidizer tank to explode—without damage to us but creating a spectacular light show visible even on the ground. As quickly as chaos came, order is restored; the second stage hums along quietly, and the window darkens again. Now a heavy hand is pushing on my chest but before I get too uncomfortable there is another lurch—and here we are, hanging in our harnesses, weightless at last. Out the window is the most amazing sight I have ever seen, a glorious panorama of sea and clouds stretching for a thousand miles in a glistening white light. In an instant, our little cubbyhole has been magically transformed. These are not ejection seats, but thrones facing out on the Universe—and we are wealthier than kings.

It is hard to believe only five years have elapsed since Alan Shepard became the first American astronaut to travel in space. On May 5, 1961, his short but successful Mercury suborbital flight burst upon the country like a breath of fresh spring air. Three weeks later, in a speech to Congress on "Urgent National Needs," our youthful new President, John F. Kennedy, outlined a lunar-landing program. Kennedy was excited about space. He asked Congress for an extra half-billion dollars in fiscal year 1962 and received it with remarkably little debate. Thus the incredible commitment was made—to journey a quarter of a million miles out into space, to land on a strange planet, to undertake an eight-day round trip—at a time when this nation's entire spaceflight data base consisted of Shepard's 15-minute foray. Radiation, meteoroids, weightlessness be damned! We were going for the home run and we were committed to doing it, in the President's words, "before this decade is out."

NASA shoots for the moon

Naturally I have no way of knowing, as John and I busy ourselves at the Gemini controls, that in a little more than three years I'll be circling the moon as pilot of the Apollo 11 command module while Neil Armstrong and Buzz Aldrin take mankind's first steps on the lunar surface. That unforgettable milestone will be the culmination of a vast and enormously complex undertaking, an effort involving thousands of scientists, designers, engineers, technicians, businessmen and bureaucrats, coordinated by an extraordinary team of NASA managers.

If Kennedy had said fly *around* the moon, the basic Mercury design could have been stretched enough to sustain one man on a six-day circumlunar voyage. But a landing! A landing led inexorably to the untested concept of rendezvous—the notion that two men could descend to the moon from an orbiting command ship in a smaller vehicle, and then find their way back. A landing, and subsequent exploration on foot, required

the development of a sophisticated pressurized suit, other specialized equipment and techniques for operating outside a spacecraft. And then, of course, there was the question of the human body being able to sustain weightlessness over the eight days required for a landing mission. So Project Gemini was needed to prove the concept of rendezvous, the technology of machines and the durability of humans. It would be a transition between the rudimentary Mercury capsule and the sophisticated Apollo system, a bridge between President Kennedy's bold objective and the national capability to achieve it.

New hardware for a new mission

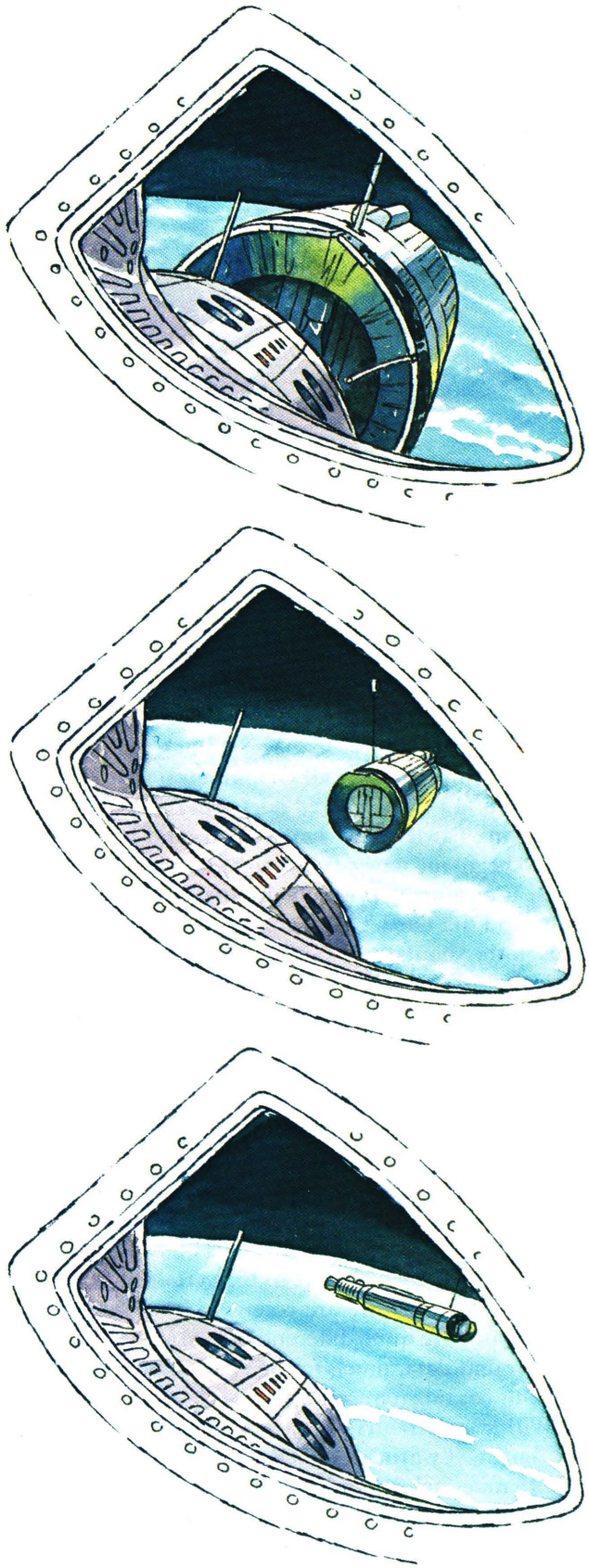
Not long after the program began, it became obvious that Gemini would have components totally unlike anything on board Mercury. Its booster would be a second generation ICBM, the Titan II, instead of the older Atlas. But the Atlas was still required, this time to launch Gemini's rendezvous target, the Agena rocket. The Gemini's nose would be fitted with a docking probe so that, once the capsule found the Agena in space, the two vehicles could be joined together as a rigid unit and then the Agena's motor could be fired to propel the docked pair into a different orbit. Radar and a digital computer were added to assist the rendezvous; the cockpit's environmental control system had to be modified to accommodate flights as long as two weeks; and a novel new power source, the fuel cell, was developed to replace the battery system, which was too heavy to provide electricity for long flights.

I had been hired as a NASA astronaut in October 1963, between the Mercury and Gemini programs. I was one of 14 in the third group selected. The original seven were the Mercury astronauts celebrated in Tom Wolfe's best-selling book (later a movie) *The Right Stuff*. The group of nine that followed were sometimes referred to by the press as the Gemini astronauts, and we 14 were dubbed the Apollo astronauts.

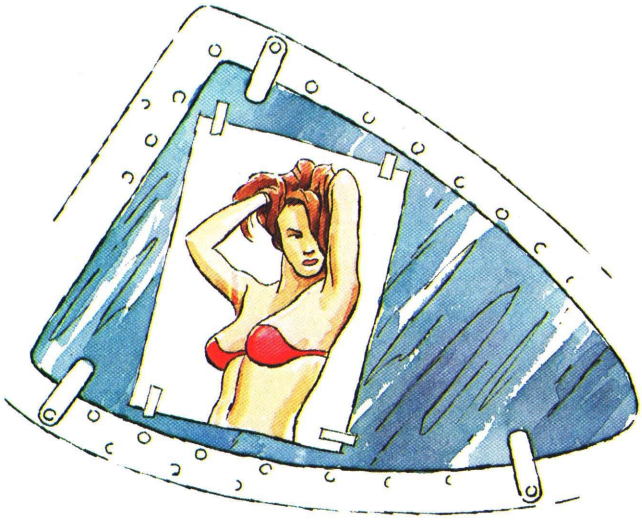
In 1964 there was only one manned mission, the first flight of a new Soviet craft called Voskhod. Nearly two years elapsed between Gordon Cooper's Mercury finale in May 1963 and the debut of the first Gemini twins, Gus Grissom and John Young. I needed that delay because I had a lot to learn.

After graduating from the U.S. Military Academy at West Point, I became a test pilot at Edwards Air Force Base in California. When I arrived at NASA's Manned Spacecraft Center in Houston early in 1964, I knew something about aeronautics but not much about Gemini. Little by little, I got comfortable with the idea that I might go into space—and fairly soon, at that.

The pace picked up in 1965. There were four manned Gemini flights that year after Gus and John



"We swing around the Agena in a tightening arc until John can guide our snout into the docking collar."



"Some kind soul has pasted on each plate a picture of a wildly beautiful girl. Up on the windows they go."

completed the premier mission, three trouble-free orbits, in March. Now, in 1966, there have been two more flights, and finally here we are in Gemini 10, an endeavor that project manager Chuck Mathews calls the "most ambitious of all Gemini missions to date."

John and I have assured ourselves that Gemini 10 is operating flawlessly as a spacecraft, and it is time for me to begin my navigational computations. The key to these is measuring precisely the angle between selected stars and the Earth's horizon. It's not as easy here as it was in the simulator. I can find the stars. They are old friends with mysterious names: Schedir, Hamal, Fomalhaut and Arcturus. My troubles begin when I peer through my sextant. Then the stars tend to disappear, especially in the airglow, the hazy layer of bright light that hovers just above the indistinct horizon.

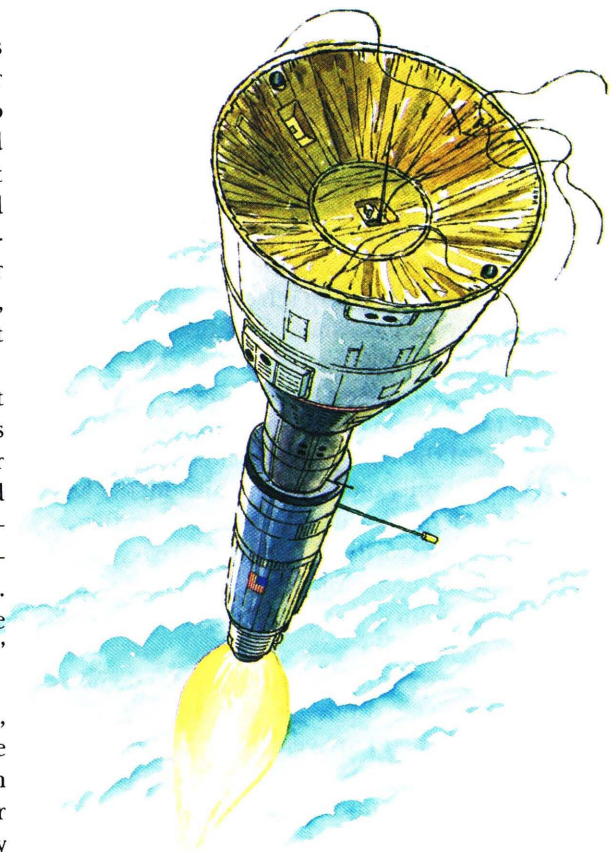
The success of our on-board navigation depends not only on accurate measurements but on tight timing as well, and yet I find myself slipping farther and farther behind as I fill charts and graphs with hastily scribbled numbers. I compare the maneuvers I have calculated—maneuvers that will enable us to overtake our Agena—with the solutions we are receiving from the ground. The results are quite different and we are forced to use the ground data, much to the chagrin of "Magellan," as John has taken to calling me.

Within four hours we have made three maneuvers, or "burns," by firing the rocket engines. As a result, we are 15 miles below the Agena and closing nicely. From now on, we're on our own: the ground can no longer help us. Until this point, we have seen the Agena only as a flashing light; we are just beginning to make out its cylindrical shape.

John is flying, and I am alternating between peering out the window and reading numbers from our computer. At a mile out, we are closing at 25 mph, which is about right. But then things start to go wrong. We have gotten off to one side somehow and our closing rate is dribbling off to zero. We have to thrust toward the Agena again, and we are swinging around it in a tightening arc. We have done this before in the simulator and we don't like it a bit. "Whoa, you bum!" John yells. We call this kind of curlicue maneuver a whifferdill, and it's the biggest fuel waster in the book. When John finally pulls up next to the Agena, only 36 percent of our fuel is left instead of the 60 percent we expected at this point.

Our spirits are restored somewhat by the docking. John guides our snout easily and gracefully into the Agena's docking collar. Latches snap into place and a motor pulls us tightly together. Everything looks OK as we prepare to start a second chase. This time we will be looking for the other Agena, the one that was left in orbit by the Gemini 8 mission four months ago.

The next rendezvous will be trickier because this target vehicle, some 100 miles above us, has long since



"I am about to tell John that we have a malfunction when—wham!—the whole sky turns orange-white."

run out of electrical power. It has no lights and—much more important—cannot respond to our radar's inquiring signal. We will have to make our moves using our eyes only.

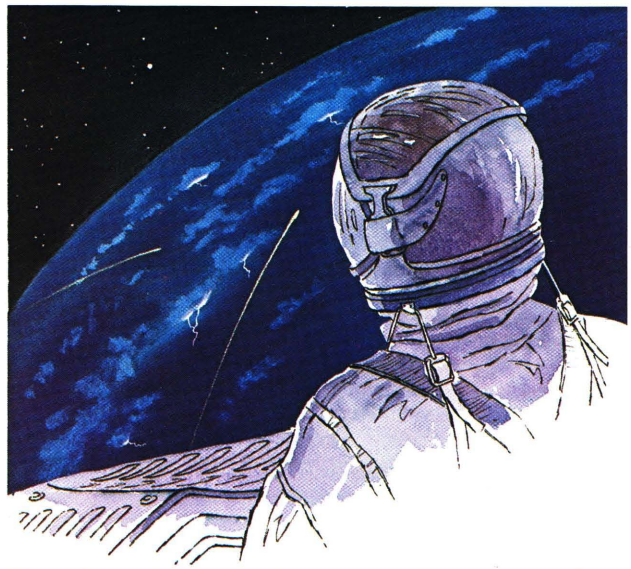
I communicate with our Agena by an encoder, a lever with which I send three-digit messages. For example, 251 means "Please turn on your lights." When we are ready to ignite its big engine, all 16,000 pounds of thrust, I tell it 041-571-450-521-501 and then hold my breath. An automatic sequence has begun. At the instant of ignition, I am disappointed to see only a string of snowball-like objects shooting out the back of the Agena. They are beautiful against the black sky, but I am about to tell John we have a malfunction when—wham!—the whole sky turns orange-white and we are plastered against our shoulder straps. It kicks like a mule, this engine, and in just 14 seconds it has added enough energy to eventually swing our orbit up to 475 miles, which is a world altitude record.

We are over Hawaii at the low point, or perigee, of our orbit, so the high point, or apogee, will occur 180 degrees from now on the opposite side of the Earth, over the South Atlantic. In the meantime, the Agena's big engine subsides, coughing and belching, and we are treated to a glorious Fourth of July spectacle. There is a golden halo surrounding the entire Agena. From its center, like a Roman candle, the engine is spitting out luminous chunks of residual fuel and oxidizer, some as tiny as fireflies, others as large as basketballs.

By the time we're ready to settle down for the night, it is 2 o'clock in the morning, Cape Kennedy time, and we have had a hell of a day. On top of everything else, my left knee has been aching for the past couple of hours, an indication that my preflight nitrogen purge did not work 100 percent. I have a mild case of the bends. Our method of turning out the lights is to clamp thin metal plates over the two windows. When we unpack them, we discover that some kind soul has pasted on each a photograph of a wildly beautiful girl. Up on the windows they go.

The first night in space is never a restful one. It's asking too much for the body to unwind, and my hands in weightlessness have assumed a life of their own. They dangle at a ridiculous angle out in front of my face, like the forearms of a praying mantis. I am afraid if I go to sleep with them in this position they may bump into some important switch. After a long while, I doze off for perhaps two hours of solid sleep. Then it's time to get going on Day Two.

Michael Collins' first book, Carrying the Fire, *was a best-seller. This article is adapted from his current book,* Liftoff: The Story of America's Adventure in Space, *due in June from Grove Press.*



"I see flashes from thunderstorms and an occasional meteor; it feels strange to look *down* on its fiery trail."

We ignite the Agena engine again to make our orbit come closer to that of our target, and I prepare for my first EVA. This initial peek outside will take me no farther than a yard above my seated position, but I am apprehensive nonetheless. After inflating our suits, we "dump" cabin pressure by opening a valve that vents the oxygen into the vacuum of space. That equalizes the pressure inside and outside of the cabin, so when I unlock the hatch, it swings outward freely in my hand. It is pitch black as I cautiously emerge to waist level. I have attached extensions to my oxygen hoses and radio leads that allow me to do this.

My first task is to photograph some stars in the Southern constellations using a special film that will register their ultraviolet signatures, or unique patterns of light. My God, the stars are everywhere, even below me! They are somewhat brighter than they appear on Earth, but the main difference up here above the atmosphere is that they don't twinkle. The Earth is barely discernible. The only noticeable light comes from flashes along a row of thunderstorms. An occasional meteor hurries into the atmosphere, and it's a strange sensation to look *down* on its fiery trail.

The sun comes up with a fierce burst of piercing white light. Shortly thereafter, my eyes begin to sting and water, making photography difficult. John is having trouble with his eyes, too, so I maneuver my huge pressurized suit back into the tiny cockpit and close the hatch. We then get on with our work.

Thanks to our Agena, whose fuel we have been using for maneuvers, we still have 30 percent of our own propellant left by the time Day Two is over. We

eat a good meal and hit the sack. Tonight this little cockpit doesn't seem like such an outlandish place to sleep and I drift off quickly.

The next thing I know, there is a voice in my ear: Houston is calling us to get started on Day Three. It's going to be a busy one. After breakfast, we make two small orbit adjustments, still using the Agena's power. Then we separate from our old friend. For the past 40 hours, we have been circling the world, often craning our necks like someone in a caboose trying to see around the locomotive up front. Now we can enjoy an unimpeded view.

We're only eight miles below the Gemini 8 Agena and closing at a cautious rate, in deference to the fact that we have no radar to assist us. We see it for the first time, a tiny speck at which John points our nose. While he tracks it precisely, I measure the rate at which our nose's angle above the horizon is increasing. By comparing these actual angles with a chart full of theoretical ones, I am able to calculate when we should depart this orbit and transfer to an intersecting trajectory. Getting there without wasting fuel is only half the problem; the other half is getting there on time—before sundown. With no radar, we would surely slide by our target in the darkness.

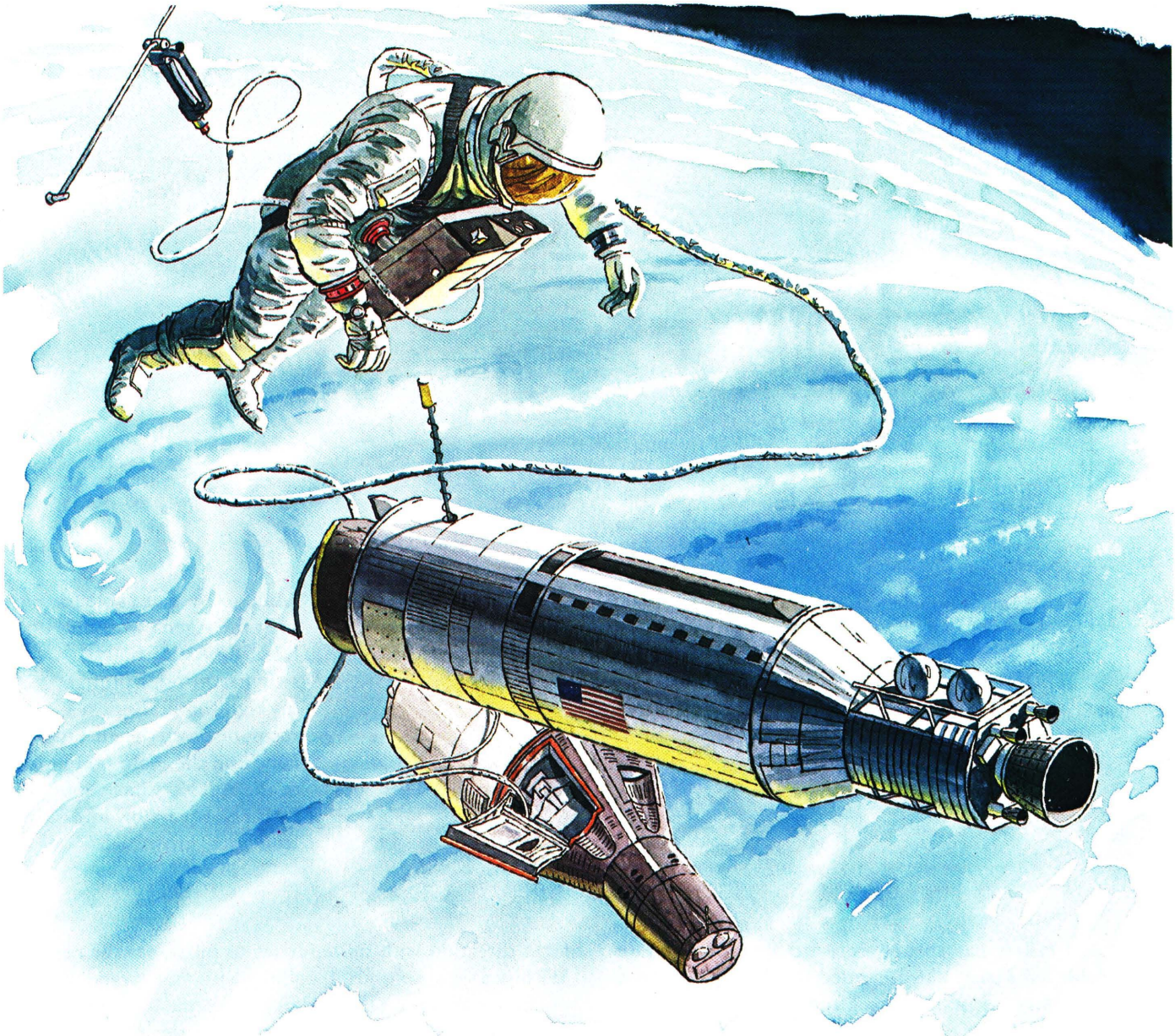
Things look good as we close in. The Agena grows from a dot to a cylinder. I give John estimates of our range and closing speed, but beyond that I can only shout words of encouragement. He brakes smoothly, and now we are riding serenely beside the Agena, with our fuel gauge reading 15 percent. Not bad!

We would like to rest a bit at this point, but we cannot. The sun goes down abruptly as usual—at the speed we're orbiting, daylight lasts for only 52 minutes—and John and I each pursue our own demanding tasks. He flips on our searchlight and, for the next 37 minutes of darkness, flies formation with the Agena. This is hard work because he must never allow it to wander out of the tiny circle of illumination from the searchlight. At the same time, he must be parsimonious with our fuel, making as few corrections as possible. While John is doing all this, I am busy unstowing and installing all the gear I will need for my space walk. There is a 70-step checklist I must go through, and these are crucial steps because once we dump cabin pressure I am utterly dependent on this equipment.

The three main items are my chest pack, an umbilical cord and a hand-held maneuvering unit. Then there are cameras, experiment packages, checklists and various minor pieces of hardware. Assembling the equipment is not a tidy process, due mainly to the bulk of the chest pack and umbilical cord. The latter has been tightly coiled under John's feet, but when it is unstrapped it expands, all 50 feet of it, and tries to fill the whole cockpit. Its function is to feed high-pressure oxygen from the spacecraft to the chest pack, where a regulator reduces the pressure and feeds it into my suit, where I will need it to breathe. The umbilical cord also contains a nitrogen hose, radio wires and a stout nylon tether to prevent me from pulling something loose. The nitrogen is routed from a spacecraft tank, through a connector just aft of the cockpit, to my maneuvering unit. This is a gunlike device that squirts a jet of nitrogen out through three nozzles, two pointed aft and one pointed forward. It has a trigger that I squeeze between my right thumb and index finger. The force of the nitrogen produces a kick in the opposite direction. By pointing the gun and squeezing the trigger in certain ways, I should be able to maneuver myself around.

Watch out for thruster No. 16!

As dawn arrives, I am on schedule and ready to go. John pulls a ring to dump cabin pressure. It takes a little while for all the oxygen to escape, like water draining from a bathtub, and while I am waiting I review some of the things I must do and not do. High on the list is a requirement to coordinate with John the firing of our thrusters. At one time or another, he will use all 16 of them to keep us in proper position next to the Agena; but if I am next to one he must wait, because its hot exhaust fumes may blow a hole in my suit or gloves. Each thruster is a small rocket motor, and dangerous. Thruster No. 16, the one that moves the Gemini downward, is of particular concern because it is located next to the connector for my nitrogen line. It is also close to the micrometeorite experiment that I am to unfasten and return to the cockpit. This package and a similar one on the Agena are both designed to measure the impact of micrometeorite bombardment.

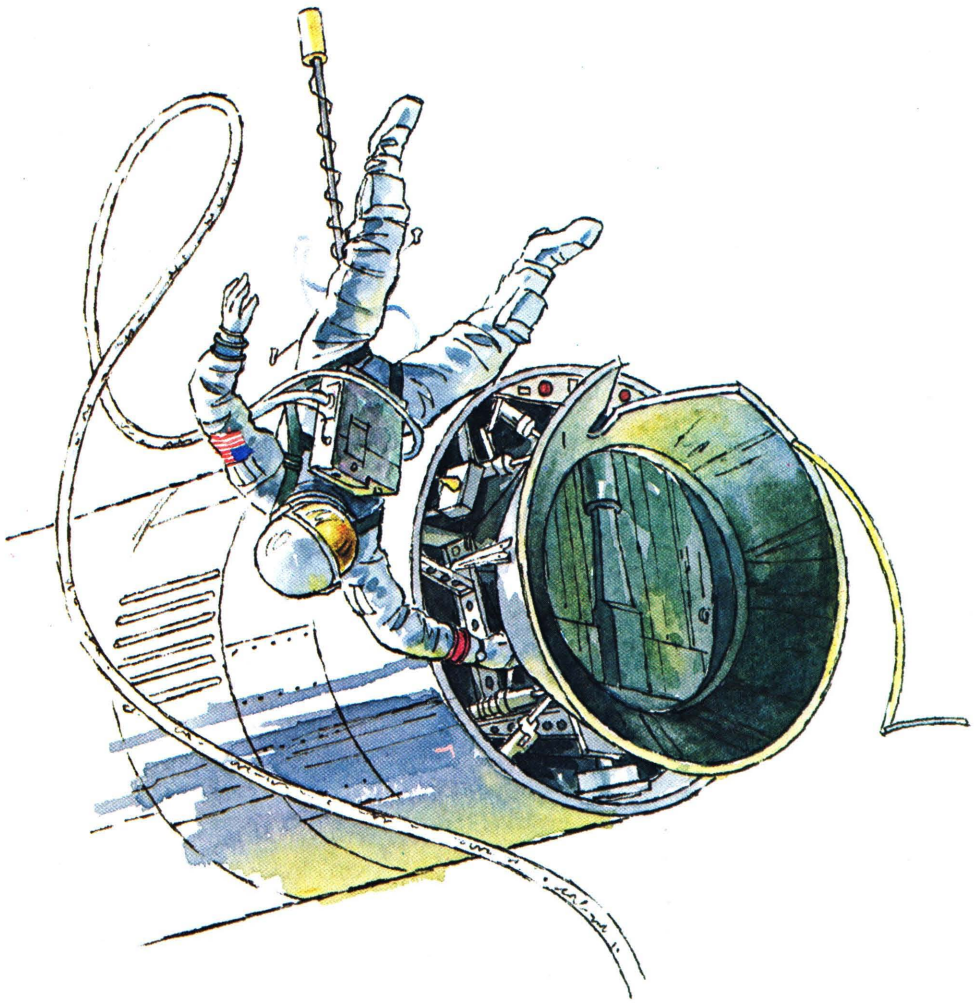


"I know that if I do nothing I will wind around the Gemini and then splat up against it at very high speed. My salvation is my maneuvering gun [upper left] but it is gone. Finally I locate the hose and reel it in."

When the time comes, I open the hatch, move out of the cockpit gingerly and raise a handrail that has been stowed flush against the side of the ship. Using the rail, I move to the rear and remove the micrometeorite detection plate that has been exposed the past two days. I caution John not to fire No. 16. "OK," he replies, but then adds, "Well, Babe, if I don't translate [move] down soon, we're going to run into that buzzard." The more nervous John gets, I've noticed, the more he calls me "Babe."

By now I am clear of No. 16. I hand the plate in to John and return to plug my nitrogen line into the connector behind the cockpit. Again I warn John and again I get the same answer. I get out of the way of the thruster, and John maneuvers. Then I move back and connect the nitrogen line, but not without encountering some difficulties.

The problem is twofold. First, my legs are flailing back and forth in response to the slightest torque that my arms put on the rail or the connector. Second, I have missed on my first attempt to stab the connector with the fitting on the end of my umbilical. The sleeve



"As I go by, I am able to snag the Agena with my left arm. As my body swings around, I plunge my right hand inside a recess between the docking cone and the main body of the Agena. I have got a fistful of wires now and won't get thrown off."

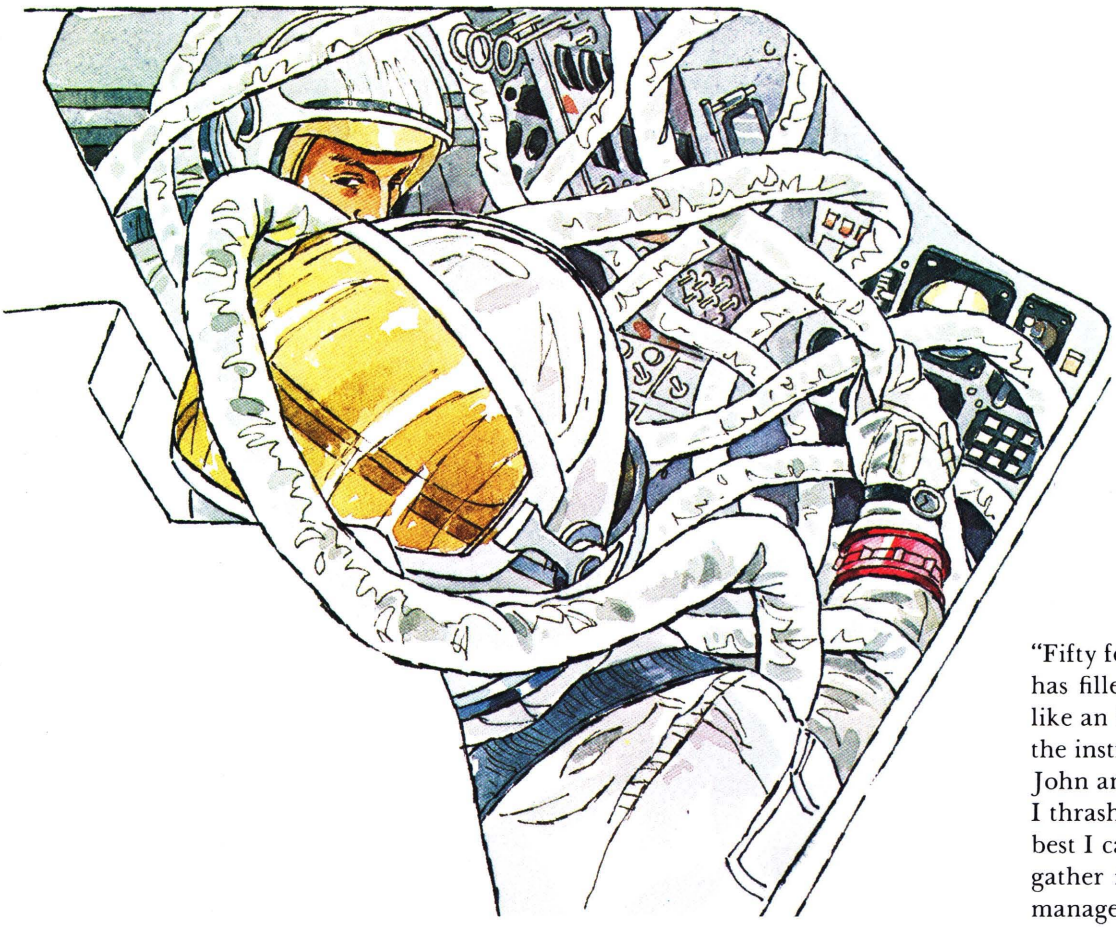
on the fitting has sprung forward and must be recocked, but that is a two-handed operation. I let go of the rail for an instant, recock the sleeve and grab the rail again. In the process, I swing wildly and my legs bang up against the side of the spacecraft. John feels the commotion and so does the Gemini's attitude-control system, which reacts to this unwanted motion by firing thrusters to restore equilibrium. "Boy, Mike, those thrusters are really firing," John says. "Take it easy back there, right?"

I return to the cockpit and talk John into position because I can see the Agena better than he can. When we are six or eight feet below and behind one end of it, I ask him to back away a little and then I tell him I'm ready to jump. "Take it easy, Babe," he replies.

Actually, "jump" is the wrong word. I push off from the open cockpit gently, trying to shove equally with each hand so that I will come away straight. As I float up and slightly forward, I note with relief that I'm not snagged on anything and I seem to be headed in the right direction with no tendency to pitch, yaw or roll. Within a few seconds I collide with my target, the docking adapter on the end of the Agena.

The experiment package I am to retrieve is on this end, but it's a bad place to land because the docking cone has a smooth, tapered lip that's hard to grasp with my inflated gloves. I head to my left to get the package, going hand over hand. As I move, I dislodge part of the docking apparatus, an electric discharge ring that springs loose and dangles there. It looks like a thin scythe with a wicked hook. I suspect it is fragile and will pull away easily; still, it is made of metal and I don't want to risk getting ensnarled.

Now I've reached the package. I try to stop but the momentum in my lower body causes me to keep going and peels my hands right off the Agena! I am turning lazy cartwheels somewhere above and to the left of everything that matters. All I can see is black sky. While I am trying to figure out what to do next, the Gemini swings into view down below me.



"Fifty feet of umbilical has filled the cabin like an ice fog, obscuring the instrument panel, John and everything else. I thrash around as best I can, trying to gather it into a manageable package."

"Where are you, Mike?" John doesn't sound too happy.

"I'm up above," I reply. "Don't go any closer if you can help it, OK?"

If John gets any closer to the Agena, which he may not be able to see right now, my umbilical might get tangled up with the dangling electric discharge ring. But that worry is suddenly displaced by another one. I have swung out to the end of my 50-foot umbilical and am moving away from the Agena. The laws of physics tell me that if I do nothing I will wind around the Gemini like a top and splat up against it at a very high speed. My salvation is my maneuvering unit, my gun. I reach for it, but it's gone! I grope around and find the hose leading to it, and reel it in. By now, my arc has taken me high off to one side of the Gemini and I am swinging around toward the rear. I start spraying nitrogen like crazy and slow down enough to make an airplanelike approach to the cockpit, gliding in from behind. I never intended to get back here and I don't like it. This is where all the thrusters are.

"I'm back behind the cockpit," I advise John, "so don't fire any thrusters."

"OK," he says, but adds, "we have to go down if we want to stay with it [the Agena]."

That is the worst possible news. Not only will the thrusters be blasting right at me but, if the Gemini goes down, I am going to skim over the top of it and begin another curlicue. "Don't go down right now," I plead. *"John, do not go down!"*

I must sound worried because he mutters "OK."

My approach is not graceful but it will do. I bang into the open hatch faster than I would like but manage to hang on. I get partway back inside the cockpit and reel the umbilical in after me. I'm going to have to try something different. John maneuvers us into position again but a bit farther away from the Agena. It looks like the docking cone is 15 or 20 feet in front and above me when I leave the cockpit. This time, instead of pushing off I use the gun.

Up I glide, but my left boot snags on something and causes me to start pitching face down. If this continues, I will hit the Agena with the small of my back, so I start squirting away with the gun. The gun not only rotates me but raises me as well, and I discover to my horror that I am about to cruise over the top of the Agena. I manage to make one last frantic correction and as I go by I am able—just barely—to snag the Agena with my left arm. As my body swings around this pivot point, I let go of the gun and plunge my right hand down inside a recess between the docking cone and the main body of the Agena. I've got a fistful of wires now and I'm not about to get thrown off.

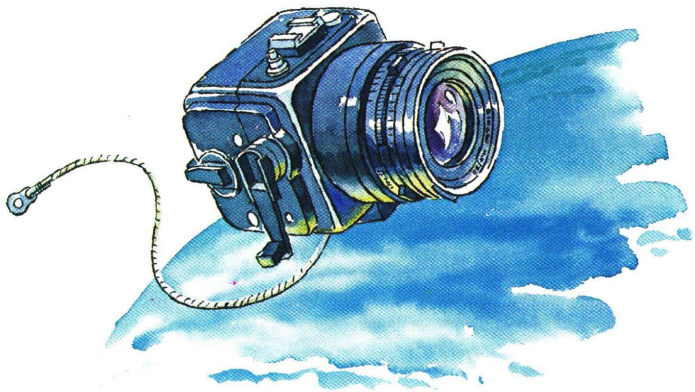
After all this, I've lost my bearings and don't know which way to go to find the experiment package. Finally, moving hand over hand again, I make my way around to it. The package is enclosed by a fairing and held in place on rails. I depress two release buttons and give a jerk. The fairing springs loose, and attached to it by wires is the package. Success! And not a minute too soon.

The Agena is gyrating around in response to all my banging. John is having a hard time staying in position and he's worried about my umbilical getting fouled up. "Come back," he warns. "Get out of all that garbage. Just come on back, Babe." That suits me fine.

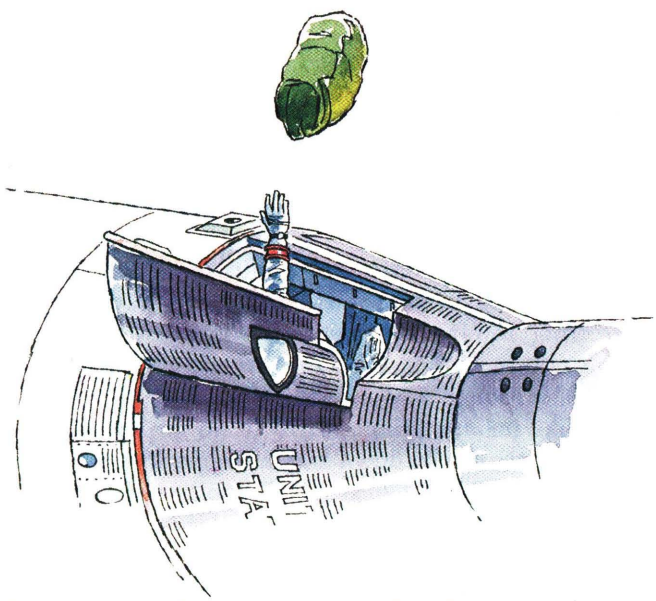
Back in the cockpit, I discover that my camera is missing. A 70mm wide-angle Hasselblad, it had been attached by a bracket to my chest pack but somehow worked its way loose and floated off. It will orbit by itself for years, full of spectacular pictures of Gemini and Agena. But there's no time to brood; we have other things to worry about.

While I'm cranking the hatch's locking handle, Houston asks John for a propellant-quantity reading. "Get serious," he growls. Fifty feet of thick umbilical has filled the cabin like an ice fog, obscuring the instrument panel, John and everything else. I thrash around, trying to gather it into a manageable package. In the process, I bump one of the radio switches, causing us to temporarily lose contact with Houston.

After jettisoning a duffel bag crammed with empty food packages, the umbilical and other equipment we no longer need, we use most of our remaining propellant to lower our perigee from 250 to 180 miles. That's a precaution in case one of our four solid retrorockets refuses to fire during reentry tomorrow. We spend the next couple of hours on experiments and then—for the first time in 53 hours—we have some free time. Actually we have a 10-hour sleep period, but we certainly don't need that much sleep. With no Agena stuck on our nose, and since we are running low on fuel anyway, we let the Gemini drift and wander.



"Somehow my camera worked loose from my chest pack and floated off. Now it will orbit for years."

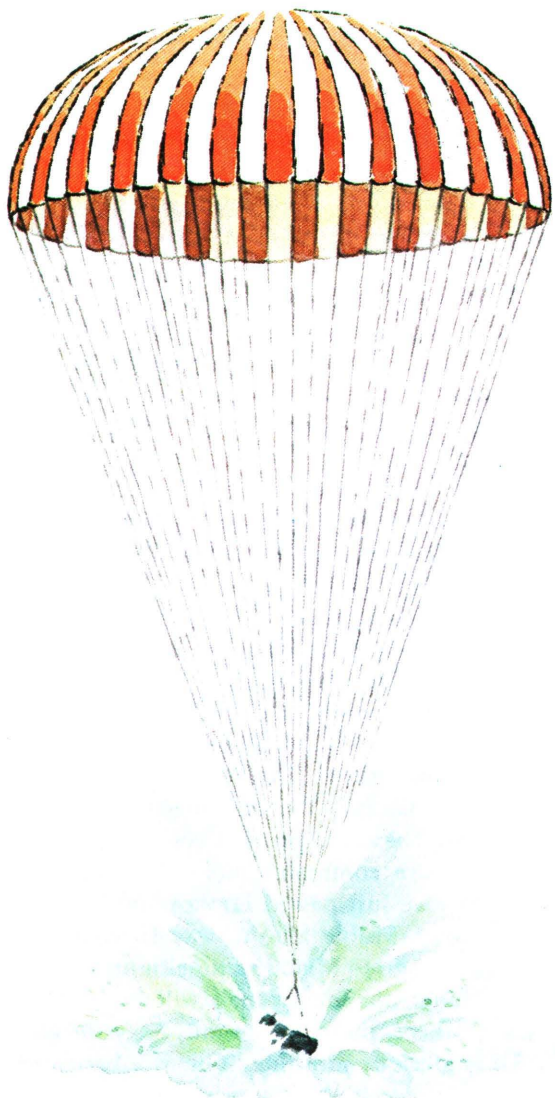


"We jettison a duffel bag crammed with empty food packages, umbilical and other gear we no longer need."

I've done loops and spins in a fighter plane, but I've never flown sideways or backward. Now we're doing that and more, tumbling slowly, smoothly, aimlessly. It's a stately roller coaster ride, utterly silent, with no jerking around and no hollow feeling in the pit of the stomach.

The view out the window is worth all the months I spent cooped up inside a simulator preparing for this mission. The curvature of the Earth 200 miles away is readily apparent. The sky is black instead of blue; otherwise the colors below are unchanged, except that the unfiltered sunlight makes clouds and water brighter and shinier. The fact that we are sailing through space at 18,000 mph is offset by our altitude, so that the ground appears to go by the window at about the same rate as from an airliner. Despite the familiarity, the feeling I get looking out the window is totally different from anything I have imagined. Those aren't countries going by, they're continents; not lakes, but oceans! Look at that, we just passed Hawaii and here comes the West Coast, visible all the way from Alaska to Mexico. San Diego to Miami in nine minutes flat! If I miss something, not to worry; it will be back in 90 minutes. Up here, there are no misty days or gloomy skies. All is glorious sunshine. This is a better world than the one down below. Savoring not only the view but also the day's accomplishments, I drift off to sleep.

Day Four begins with the usual bugling from be-



"'We're going to hit like a ton of bricks, I announce. Amazingly, we don't. We plop softly into the Atlantic."

low—in this case, our ground station in the Canary Islands. After breakfast, as we make our final orbit, we thank the folks in the various tracking stations we pass over. "Have a good trip home," Canary says. John makes his speech: "Roger. Thank you very much. Enjoyed talking to you. It's been a lot of fun. . . . Want to thank everybody down there for all the hard work." This is more than just a pro forma courtesy. Because of our excessive fuel usage, the troops in Mission Control have really been put to the test. They have done a masterful job of reshuffling the schedule and getting extra work from our Agena, so we have accomplished almost everything we set out to do.

Retrofire is a serious business. It involves firing our rockets in order to slow down and drop out of our orbit. We prepare for it with a solemnity that exceeds even that of the launch. Every item on the checklist is marked off carefully, and then the marks are checked. We even discuss *how* I am going to punch a particular row of buttons. "Push them in the center, push them down hard, and hold them down for a good fat one second," John lectures me.

As retrofire time approaches, I find myself peering out the window for the tenth time to make sure that our heat shield is pointed forward, so that the retrorockets will slow us down and not speed us up. If we mess this up somehow, we will become a permanent Earth-orbiting satellite. Canton Island in the South Pacific comes on the air with the inevitable countdown, "3 . . . 2 . . . 1 . . . RETROFIRE!"

Four welcome slaps on the back

After three days of weightlessness, my body is supersensitive. I feel each of the rockets slapping me on the back as they fire, one after the other. "I count four beautiful ones, John-Babe." "Yes," he replies, and then reports to Mission Control, "That was a superfine automatic retrofire—303 aft, 5 right, 119 down."

He means that our velocity has been reduced by 303 feet per second forward, 119 feet per second down toward the Earth, and five feet per second to the right. This is almost perfect. Now we jettison the retrorockets, exposing our heat shield, and John concentrates on steering toward the point at which our computer thinks our landing ship, the aircraft carrier *Guadalcanal,* is located, 530 miles southeast of Cape Kennedy. It's like making gliding turns in an airplane, except that we are upside down and facing backward.

I can tell that the heat shield is doing its job because we are developing a tail. Tenuous at first, then thicker and more startling, it glows an eerie red and yellow. John has seen this before but I have not. "Man, that's starting to look like something," I exclaim. "Look at that son of a gun burn!" Occasionally a small chunk of

heat shield breaks loose and adds sparkle to the halo. "Fly that thing, John! You're doing a beautiful job."

At 38,000 feet we release our drogue parachute, which is supposed to stabilize us. Instead, we begin to swing back and forth. "Shoot," John grumbles and he deploys the main parachute early. It fills our windows with red-and-white reassurance. Houston reports that they can see us on TV, so we must be in the right place. When we swing down to the horizontal position, we can tell that we are rotating on our parachute because the clouds are whizzing by our windows sideways! I figure this strange motion is going to increase our descent rate. "Boy, we're going to hit like a ton of bricks," I announce. Amazingly, we don't. We plop softly into the Atlantic. We must have caught the lip of a descending wave.

It is a mild and gentle day and the sea is mercifully quiet. My ears are blocked from the swift descent, and there is an unaccustomed aroma of burned chemicals in the air. Outside my window, the nose-mounted thrusters hiss and smoke, emitting an occasional tendril of weak flame. A helicopter flashes past our prow, and then swimmers appear and surround us with a stabilizing rubber collar. Gemini 10 flies no more. We are trespassers here, at the mercy of a new set of EVA experts clambering around us. I tell them, "Hey boys, take your time. We're not in any hurry. We don't want anyone getting hurt out there." It is over.

"Outside my window, the thrusters hiss and smoke. A helicopter flashes by. . . . Gemini 10 flies no more."