OFFICIAL PLAYER'S GUIDE

STAR WARS® REBEL ASSAULT™ II

The Hidden Empire™

Covers PC and Mac versions

The Making of a CD-ROM Masterpiece

by Jeff Hoff

LUCAS Arts®

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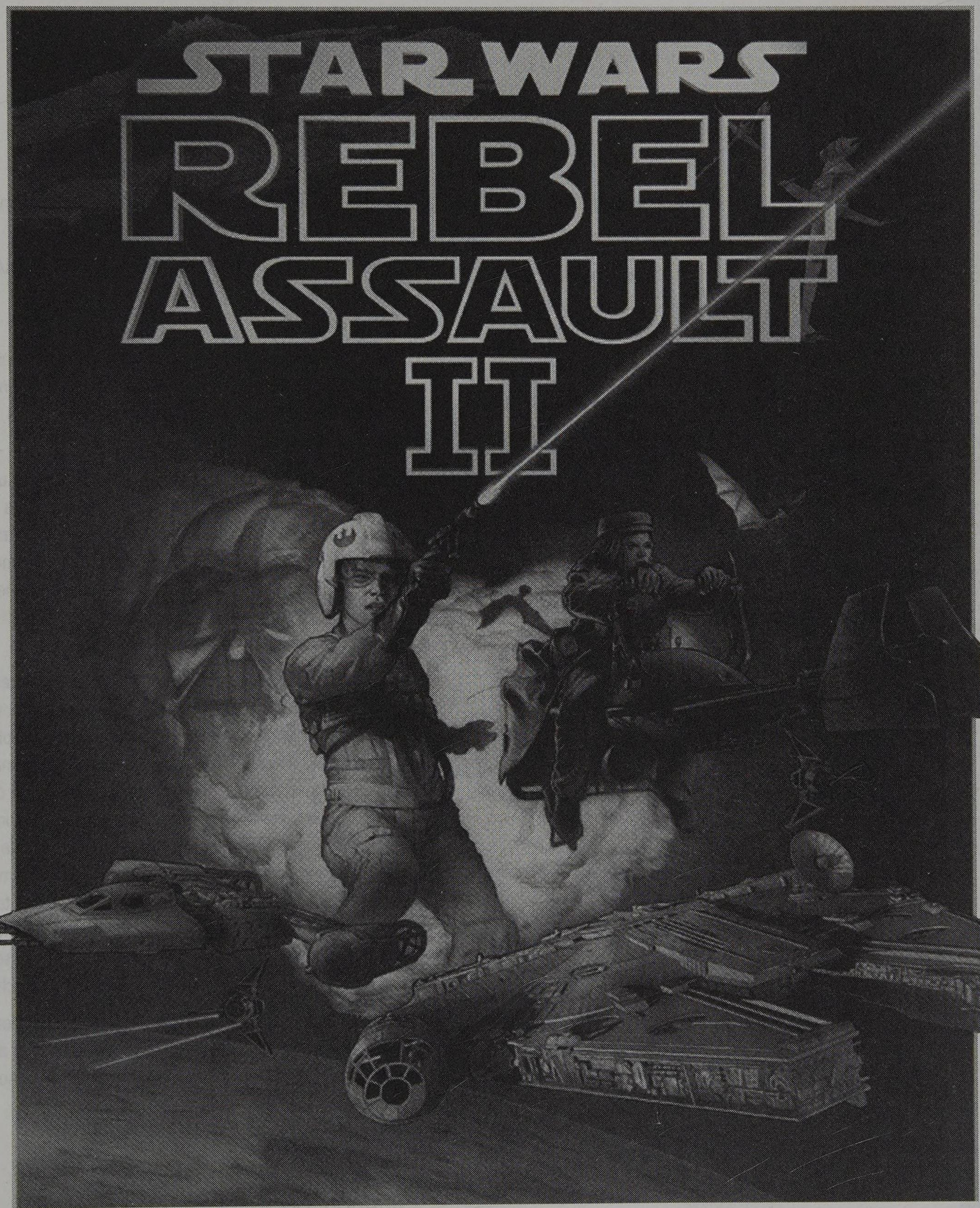
OFFICIAL PLAYER'S GUIDE

STAR WARS REBEL ASSAULT II



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To Abraham, Esther, and Jerry.
It *is* good to co-create.

ACKNOWLEDGEMENTS

Creating a book about *Rebel Assault II* at the same time the game development was wrapping up puts a whole new spin on the game-industry term "crunch time." This book would not be nearly as complete or as beautiful without the yeoman skill, generosity, and patience of many people at both LucasArts and Infotainment World.

At LucasArts, Vince Lee and Steve Dauterman gave me access (a writer's most vital requirement) to everyone who had anything to do with the game. They also supplied me with quick answers whenever I called. Richard Green and his talented team of 3-D animators ignored their own deadlines to create the terrific art shots for the book's color section. Brian Kemp and his testing crew (Chris Snyder, Matthew Azeveda, Albert Chen, and Brad Granthan in particular) provided great game tips and sample settings for the game's Difficulty Editor. Special thanks to Rachel Bryant and Llesll e Aclaro for their unflagging good humor and favors (including Rachel's computer when mine went berserk), and to Garry Gaber for his 11th-hour technical aid that saved my life.

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INTRODUCTION

After the meteoric success of the original *Rebel Assault* (more than 1.5 million copies sold worldwide — and counting) Designer and Programmer Vince Lee perhaps felt a little bit like George Lucas himself after the release of *Star Wars.* What now? How do you follow up a "phenomenon?" How could you possibly create another product that would outdo the standard by which all other products are measured? In other words, how do you make another mega-hit?

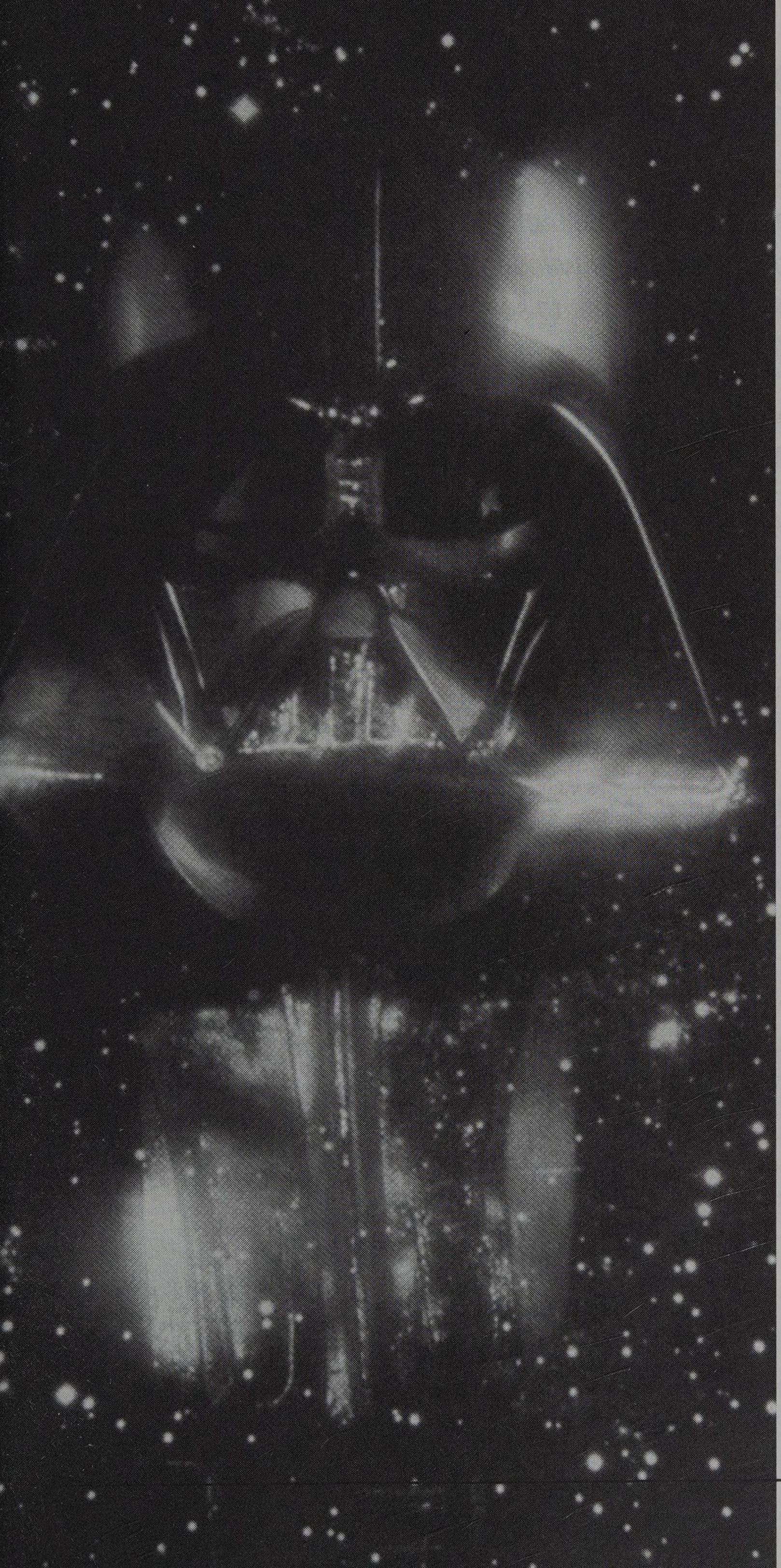
The answer is bit by bit (or, in *Rebel Assault II*'s case, byte by byte) and this book describes, from conception to completion, just how Lee and his talented team of LucasArts directors, artists, musicians, technicians, and testers pulled it off.

But *The Rebel Assault II Official Player's Guide* is much more than a "making of" documentary. It's a training manual for *Rebel* aces and joystick jockeys who want to soar to the top of the High Score screen in *Rebel Assault II*. The first three chapters supply you with everything you need to climb from rookie pilot to "fighter jock." Chapter 1, Cheats and Passcodes, gives you the technical know-how to travel instantly to any chapter of the *Rebel II* universe and to adjust certain "mechanical parameters" of your ship to drastically enhance your chances of survival and success. Is this ethical? Hey, everyone needs to train. After you get comfortable, you can always replay back without the aids.

Chapter 2, Rebel Tips and Strategies, is the shank of the book. The hardy band of game testers at LucasArts spilled their guts to me as they played the chapters over and over. If you can't survive any section of *Rebel II*, this chapter will get you through. If you want to know secret targets to shoot in order to boost your score, this is where you want to linger. If you want to know tricks of the game-tester trade — well, you get the idea.

Chapter 3, Stop Being Difficult, explains the weird technical jargon (Snap Distance, Target MaxSize, etc.) of Vince Lee's Difficulty Editor, which is an innovative first for LucasArts that that lets you customize many of the game's gameplay parameters. Step by step you can tweak *Rebel II's* gameplay so that it best fits your style and ability. If that sounds too complicated, or you want a new challenge just handed to you, this chapter includes three sample difficulty settings created by the best of the LucasArts tester crew.

After you've mastered the game — and experienced first-hand its breakthrough art and game technology — you'll wonder how in the world they did it. Look no further. From Chapter 4 on, you'll learn straight from the horses' mouths exactly how they out-Rebelled *Rebel Assault* and made the next CD-ROM megahit. You'll discover that computers and video technology and the graphics software and Pentium chips and many other things electronic had a big role, but it's good old-fashioned human talent and skill that were the true champions of *Rebel Assault II.*



CHAPTER 1

CHEATS AND PASSCODES

Cheats and Passcodes

Every game has its secrets lurking within the code, and Rebel Assault II *is no different. This chapter gives you a handful of cheats and all the passcodes you need to navigate instantly to wherever your wanderlust takes you. The cheats, by the way, were created to simplify debugging, not to spawn artificial champions. But sometimes you just need a little edge on the competition.*

SO YOU WANT TO PLAY LIKE A GOD?

Having a little trouble negotiating the Mining Facility? Can't slip by the second set of stormtroopers in Chapter 2? Don't get frustrated. Get the god codes. To access the following cheat modes, pause the game, press ALT-V (Cmmd-V on the Mac), and type in the appropriate code. You are then able to use the designated keyboard commands within that mode. You need to be in Force mode to enter Yoda Power mode.

Force Mode

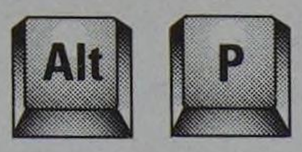
Type LETGO

+ Reduces damage	This decreases your damage.
– Restores damage	This increases your damage. Why would you ever use it? Unless you're suicidal, you wouldn't. It's for testers who need to put the game through its paces at every level of damage.
Alt E Extra life	This grants you one extra life so you can keep fighting the good fight.
Alt L Unlimited lives	Fight forever! You get an unlimited number of lives.

Yoda Power Mode

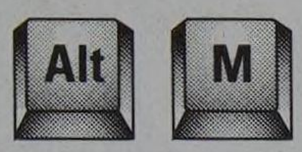
Type ISNOTRY

Esc Skip playable section	Tired of combat? This jumps you to the next cut scene.
Alt J Jump	This allows you to hop from one chapter to another. To jump to Chapters 1 through 9, press Alt-J and the corresponding number. For Chapters 10 through 15, type in A, B, C, D, E, F, respectively.



Autoplay

Are you a watcher or a doer? If you're a watcher, press Alt-P. The computer will pilot Rookie One, which can be very educational.



Movie mode

Don't go to the video store for a movie, press Alt-M to watch *Rebel II's* cut scenes. Rated PG.

THE PASSCODE, PLEASE

Rebel Assault II uses passcodes to allow players to access higher levels. When you save pilots, you save the passcodes that they've accumulated, so you can enter the passcode to jump to any chapter for which they've qualified. You can also use these saved passcodes to qualify another pilot.

Another wrinkle in this scheme is that the chapter passcodes are different for each of the four difficulty levels — Novice, Beginner, Standard, and Expert. In other words, if you qualify for Chapter 6 in Beginner mode, you don't also receive the passcode for that chapter in Expert mode. You have to earn it. It's like trying to prevent people who pass their driver's exam on a motor scooter from going out and cruising on a Harley.

But, of course, there's always a shortcut around such well-intentioned schemes, and this section is one of them. The following chart lists all the passcodes for all the chapters and all the difficulty levels. Chapter 1 doesn't need a passcode, of course, but there are still 15 passcodes — the last one jumps you automatically to the non-playable, full-motion, grand-finale video extravaganza. To use the following codes, choose the chapter you want to play, then enter the code for your selected difficulty level.

Chapter	Beginner	Novice	Standard	Expert	Custom #1, 2
Chapter 2	JABBA	EWOKS	BANTHA	ANAKIN	WOOKIEE
Chapter 3	ENDOR	CHEWIE	KATANA	KENOBI	DROID
Chapter 4	LACHTON	DANKIN	DENGAR	FORTUNA	RODIAN
Chapter 5	BORSK	NOGHRI	PELLAEON	MODON	BPFASSH
Chapter 6	KROYIES	CHAMMA	ITHULL	OMMIN	KSHYY
Chapter 7	AURIL	BOGGA	STENNESS	REKKON	TORVE
Chapter 8	KAMPL	INCOM	MYRKR	SHAZEEN	SLUISSI
Chapter 9	FERRIER	KOTHLIS	CHURBA	KIIRIUM	PALANHI
Chapter 10	GALIA	KRATH	ARTOO	GUNDARK	DROKKO
Chapter 11	DENARII	SIOSK	SATAL	DIANOGA	NATTH
Chapter 12	SADOW	ADEGAN	LOBUE	ATUARRE	SABACC
Chapter 13	ONDERON	AMANOA	DENEBA	ESSADA	ANDUR
Chapter 14	ALEEMA	AMBRIA	STURM	PAPLOO	ARKANIA
Chapter 15	CATHAR	SYLVAR	CRADO	NASHTAH	DIATH
Finale	DOMINIS	MIRALUKA	CARRACK	PESTAGE	DREEBO

CHAPTER 2

REBEL TIPS AND STRATEGIES

Rebel Tips and Strategies

With an arcade action game like Rebel Assault II, *you don't need tips that show you what to do next or where something is hiding. You needs tips to know how to survive. That's first. After you have survival down pat, you need tips to know how to thrive — which means accumulating mondo points, which means more lives, which means high scores and your name emblazoned forever in the* Star Wars *pantheon of fighter jocks.*

Let's get right to the essential tips and strategies, chapter by edge-of-the-seat chapter. These secrets, by the way, are battle tested to the nth degree — they're provided for you by the able and sharp-shooting testing crew at LucasArts. They ran the game through its paces for many months under every conceivable condition. Take a few Zen-like, quiet moments to more fully prepare for battle and consider these few aesthetic and tactical suggestions from the pros.

GENERAL TIPS AND SUGGESTIONS

Tester James Evans strongly suggests you go out and buy a computer that can play *Rebel Assault II* in high-res mode if you don't have one already. "It just looks fabulous," Evans said. "It looks great in low-res, too, but it's incredible in high-res."

As a blanket rule, Tester Scott Douglas urges you to remember one word: Patterns. "Learn the patterns, the flow of Vince Lee's pre-set flight path through each airborne chapter, and you win the game," Douglas said. "And keep your eyes on the targets and not the pretty pictures — until you get good enough to do both."

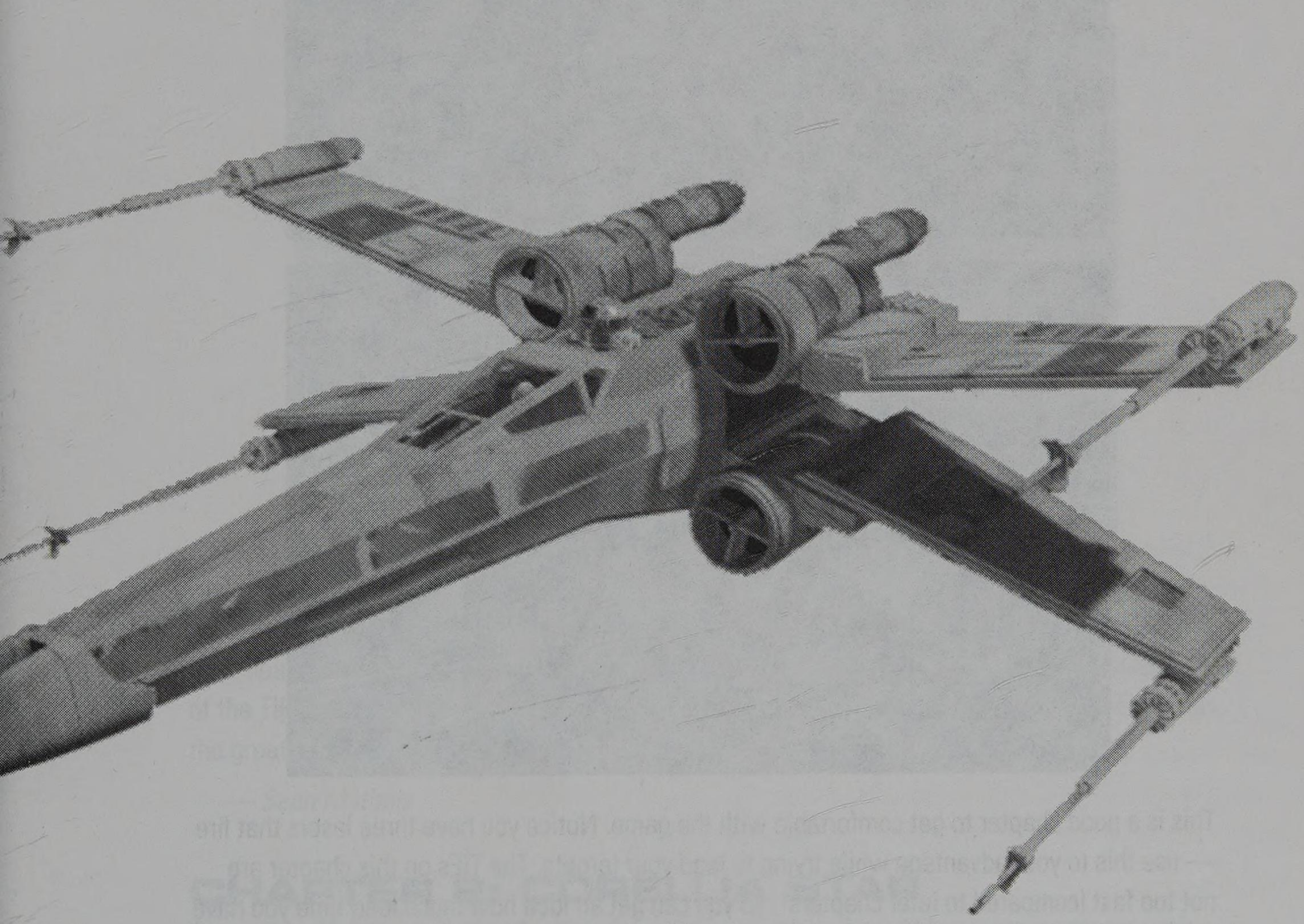
If you're having a hard time with any chapter, Albert Chen recommends that you "change the frame rate in the launcher's 'Advance Settings' [either increase it or decrease it depending on the chapter and your personal preference] so that you can have more time to react."

Concerned about stormtroopers? Don't worry, said Chris Snyder. Just remember two things when you engage these "Imperial bucket heads," as he calls them. "First, try to limit your shots. If you fire rapidly while the troopers are firing, it makes it very hard for you to keep track of your shots." Second, "it's usually better to keep your shots level, moving left and right, making minor adjustments as you go along. Moving your cursor wildly about only makes things more frustrating."

There is ground warfare in *Rebel Assault II,* but the game is known for its super-realistic cockpit dogfights. Here's two general strategies, the first from Sean Matheis and the second from Matthew Azeveda, to get your twitching fighter's mind into the right perspective. "Fire at enemy ships as soon as you see them

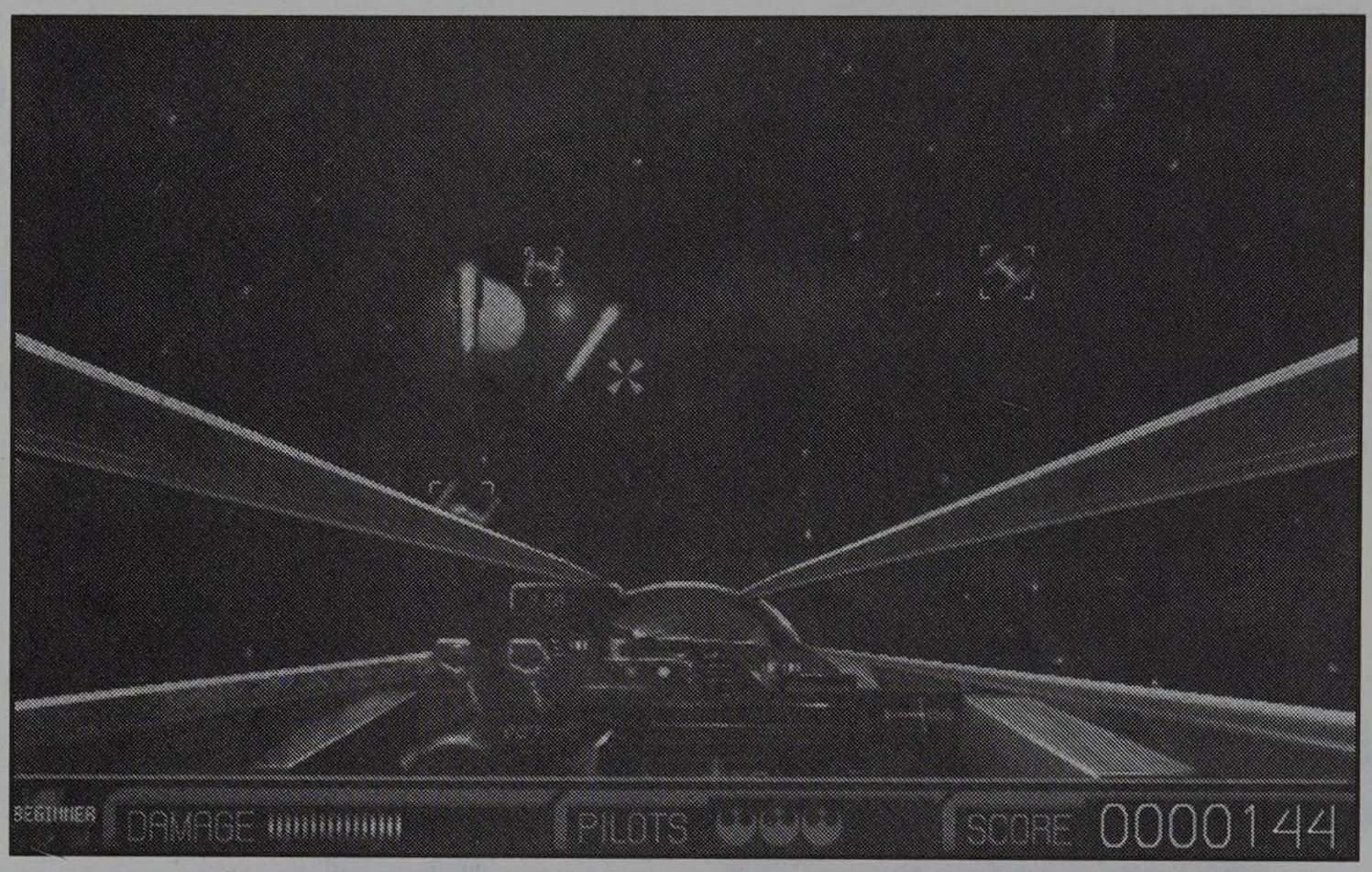
or you'll get too overwhelmed and won't be able to decide who to destroy first," Matheis said. "Don't wildly move your targeting cursor all over the screen chasing ships like a droid. You'll hit fewer that way. Be calm and steady, like a Jedi...like me." Azeveda's advice is to "keep your cross-hairs a little ahead of your target's flight path. The enemy will usually fly right into your sights. Don't get distracted by the flashes of light and turbulence on your craft. That's just Imperial blasts ripping through your shields and hull. Depending upon your difficulty setting, the damage is usually minimal. The sooner you take out enemy ships, the less chance they will have to fire at you accurately."

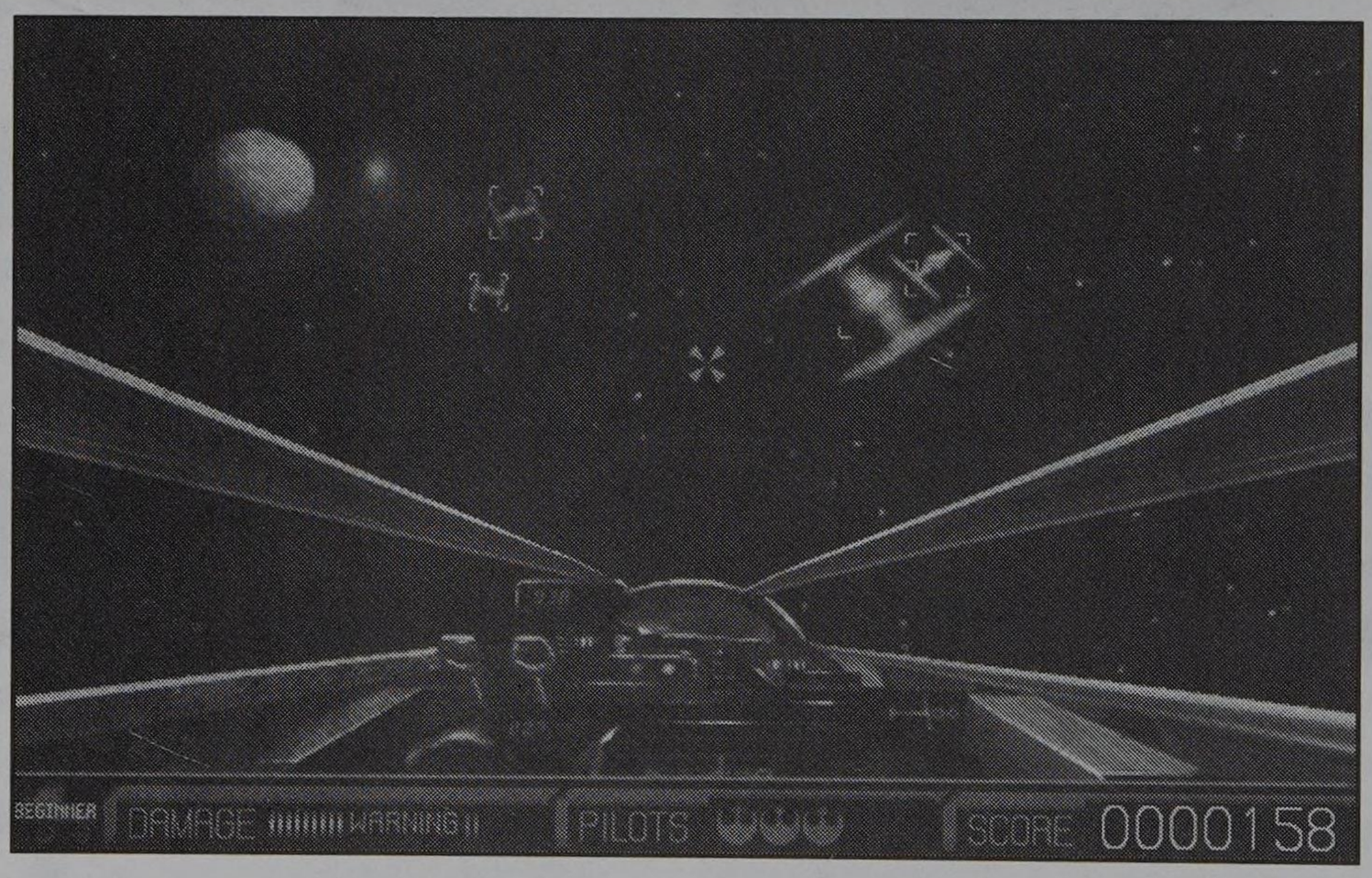
In the final analysis, however, as lead tester Brian Kemp points out, the only way to beat any arcade-style game is to play it. A lot. "The best hints and know-how come with time and practice," he says. "Keep playing and you'll pick up the patterns like you pick up any new skill." In the meantime, here's the straight scoop from the pros.



CHAPTER 1: DREIGHTON TRIANGLE

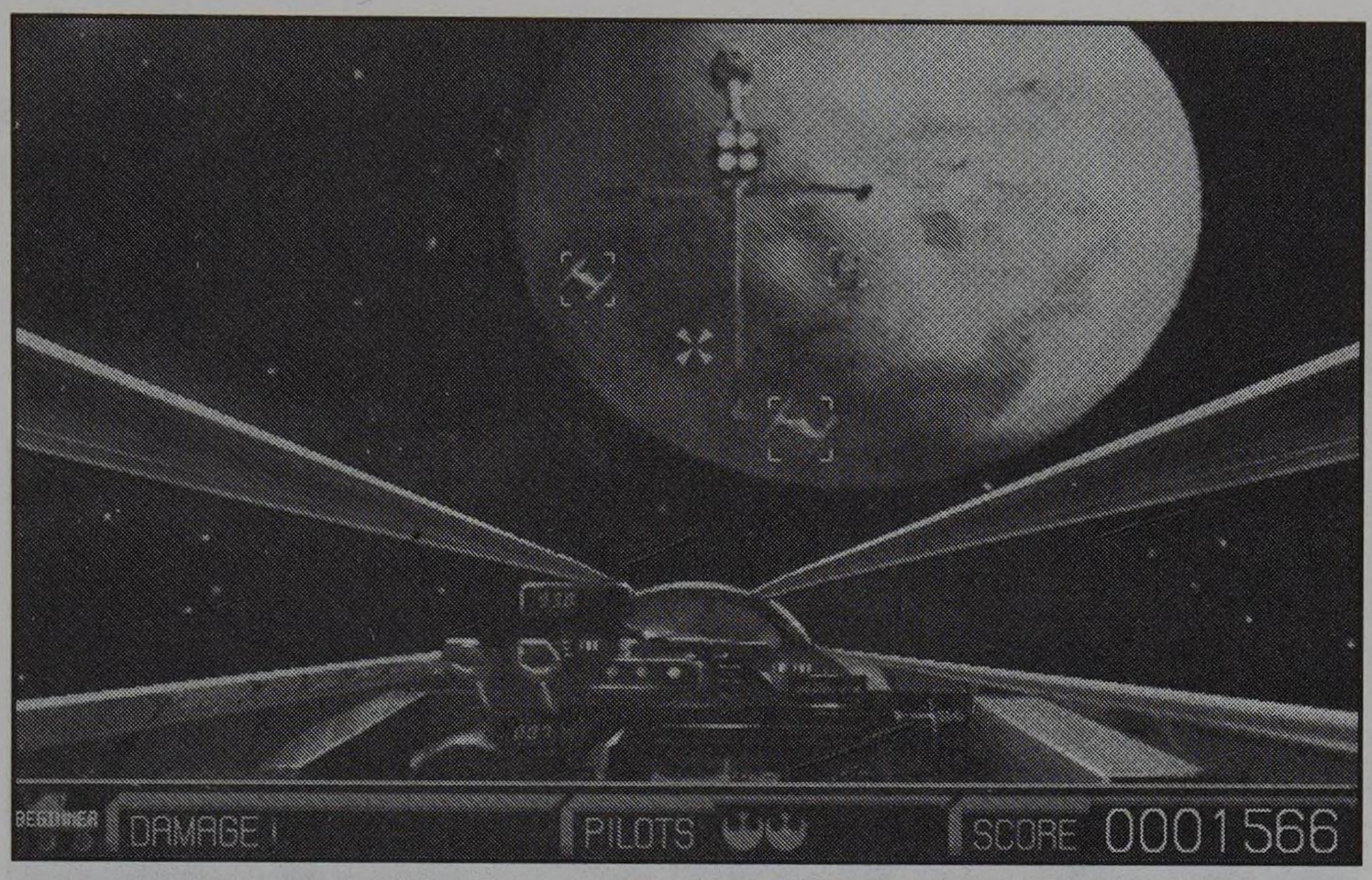
You start with a long, relatively leisurely space dogfight to help you get your feet wet, your adrenaline flowing, and your trigger finger fast and loose. There's just enough time to ogle the dazzling graphics and to know you're not in *Rebel Assault I* anymore. Prepare to be mesmerized.

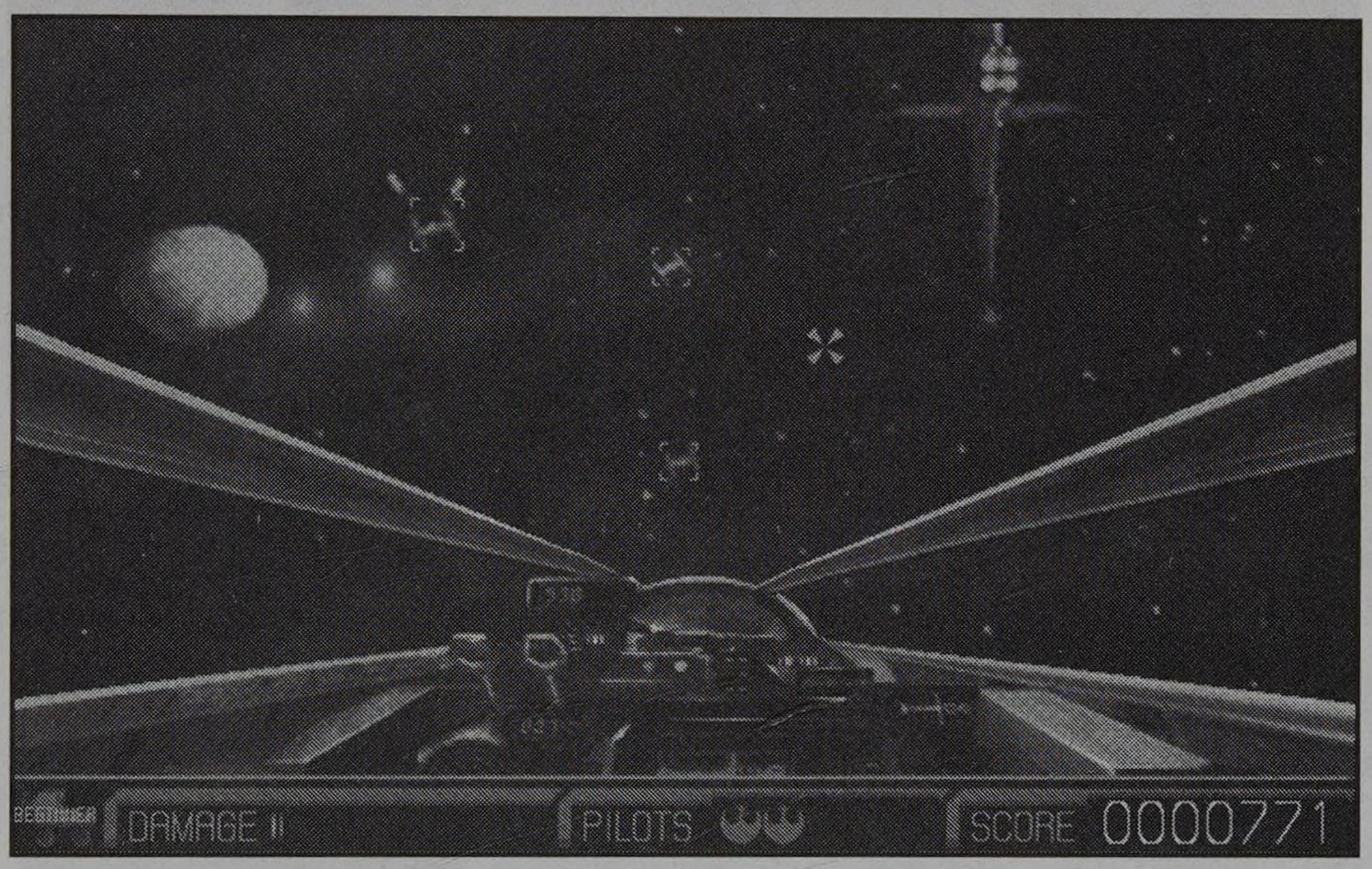




This is a good chapter to get comfortable with the game. Notice you have three lasers that fire — use this to your advantage while trying to lead your targets. The TIEs on this chapter are not too fast (compared to later chapters!) so you can get an idea how much lead time you have to give the fighters to get them every time.

— Brad Grantham





One approach is to try to keep your fighter toward the center of the screen. This way, you can react to any new threats as quickly as possible. Besides, the flight path of most of the TIEs will pass near, if not through, the center. After flying a lot, you'll be able to memorize the pattern of the TIEs (they're quite predictable: Imperial training and all), then you'll be zapping TIEs with the greatest of ease.

— Sean Matheis

CHAPTER 2: CORELLIA STAR

Once air battle's done, it must be time for a little ground warfare. This engagement gives you three pitched battles (or stages) against stormtroopers.

Stage 1

You may find this first ground-level battle easier to play with a mouse instead of a joystick, although others think that's poppycock. The key to winning ground battles is to keep under cover, and the mouse lets you keep your target in place while you pop in and out of cover.

— *Sean Matheis*

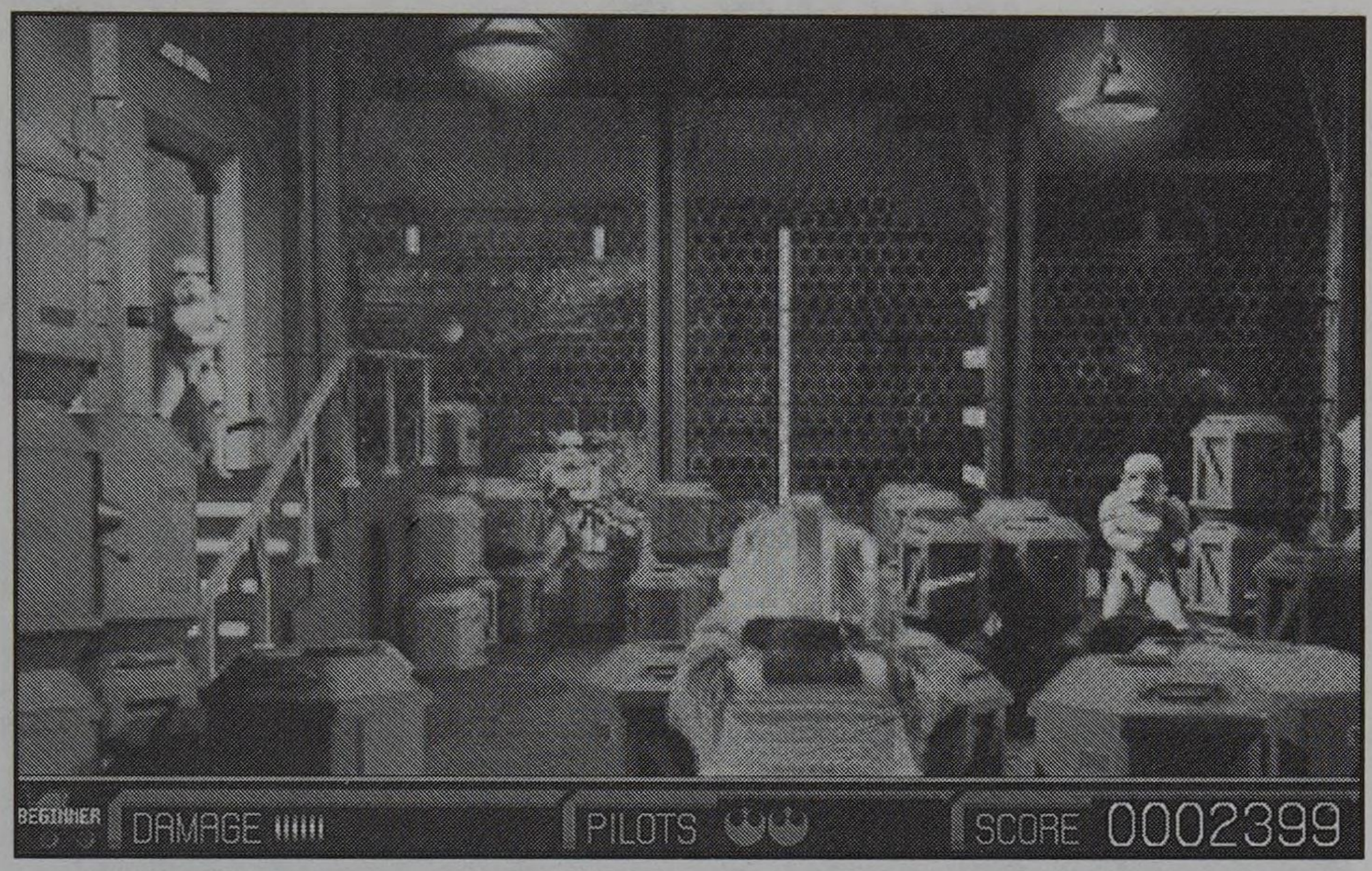
The key to this stage (all three stages, actually) is patience. Target your crosshairs on a stormtrooper and take no more than two or three shots before going back for cover. Sit and learn the pattern in which the troopers appear. If you wait, you will find their weaknesses and be able to get through the three stages on this level with minimal damage.

— *Chris Snyder*

Stage 2

This is the toughest of the three battles in this chapter because all three stormtroopers pop out at the same time. (This is not a major obstacle in this first ground chapter because it's not that difficult, but it can be a problem in later ground battles.) The trick is to stay behind your barriers until at least two of the scum duck back behind their cover. Then you can blast the single trooper. If you enter the level crouched, you can get these guys more easily — and reduce your damage. Every little bit helps.

— *James Evans*



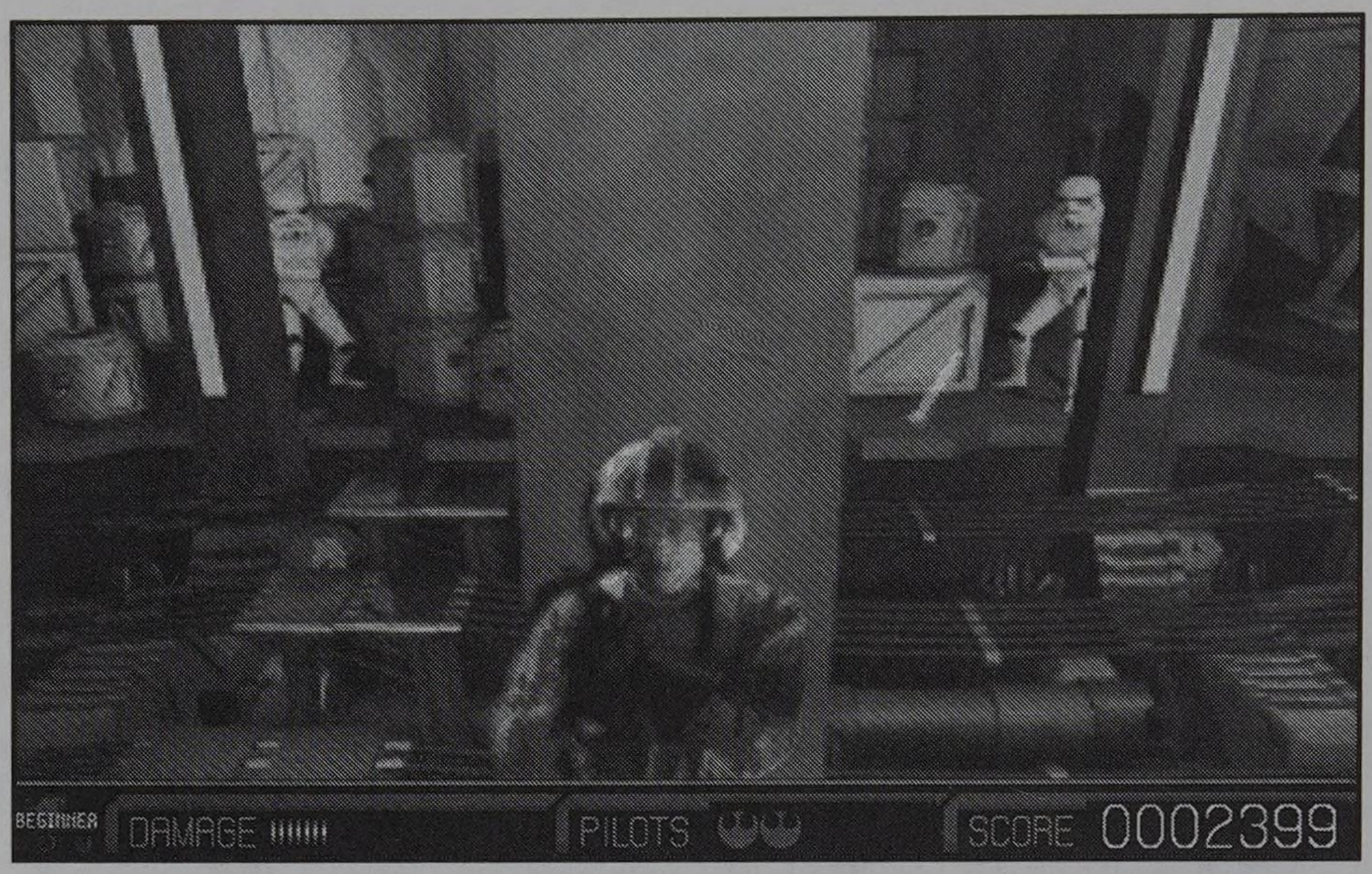
There must be something worth shooting here other than stormtroopers. How about a roof light? The one on the left is invincible, but the one on the right might give you some points.

— Brad Grantham

Stage 3

After the cargo tram passes, get ready and take aim. Troopers have taken up positions without your seeing them. (Ah, but the true Jedi would've sensed that, right? Well, you're just a rookie.)

— Matthew Azeveda



Stay centered with Rookie One facing you. That way you can see troopers coming in from both sides and quickly pick off one trooper on one side, duck back, then shoot the other guy. If you stay to one side, the beam blocks you from seeing the trooper on the other side. Worse, you can't shoot him, but he can shoot you. The two troopers alternate, so you have plenty of time. Maintain the center position. Duck out, fire, then duck back.

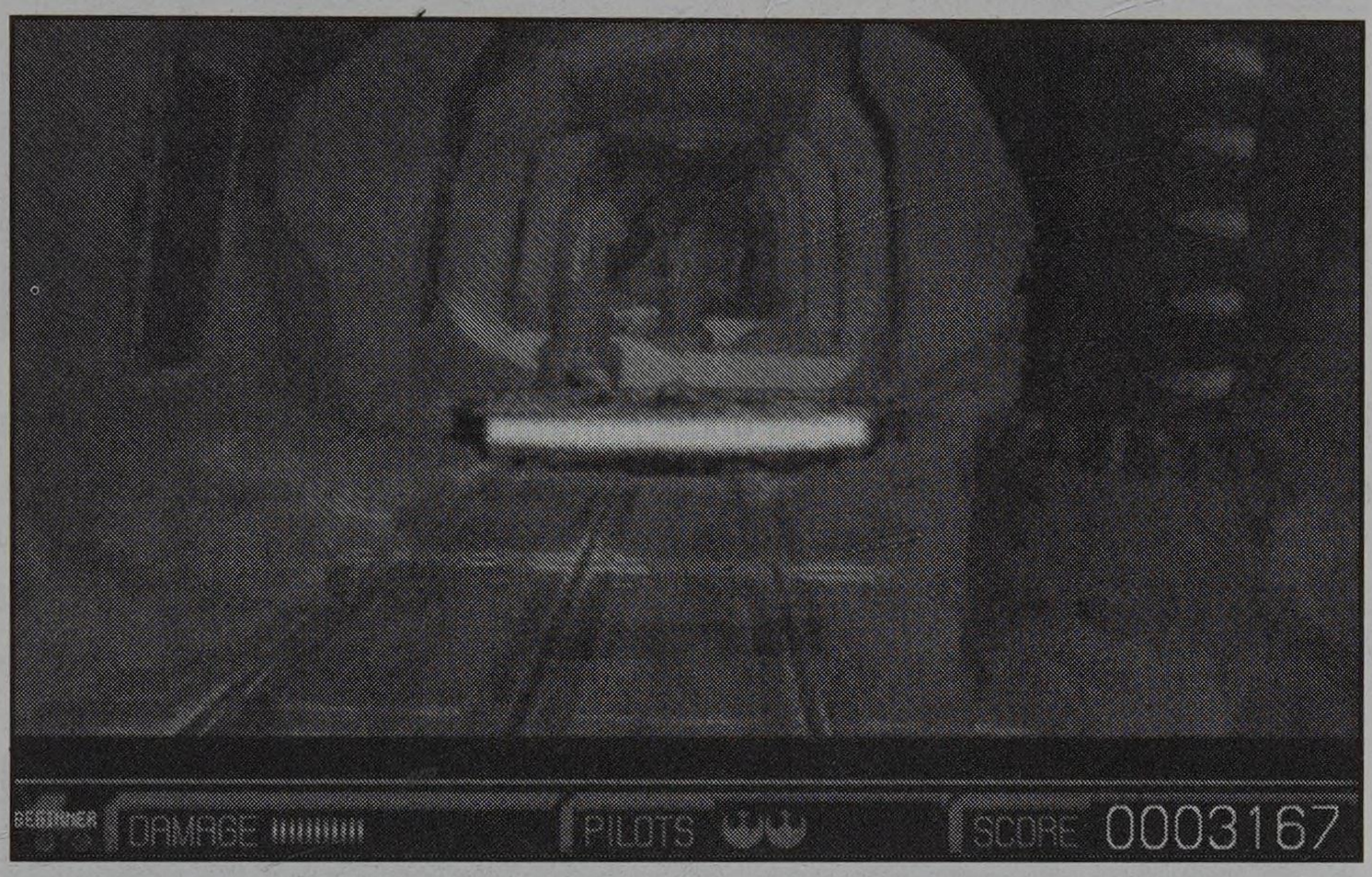
— Albert Chen

You want extra points? Try to shoot the small red Imperial emblem on the rear middle section of the cargo tram as it passes along the high voltage tracks. Besides, in this game, you should shoot everything to get points for extra lives. When you hear the R2-D2 whistle, you know you've won one.

— Chris Snyder

CHAPTER 3: MINING TUNNEL

Back to the flight plan. This level features two distinct stages, the first a third-person, follow-the-ship view, and the second an in-cockpit view. This level is definitely easier with a joystick than a mouse, according to James Evans. "You can't change the mouse control in *Rebel II,* as you can with the joystick. Tighten the controls when you're flying through areas that require very subtle movements, like the pipes in this chapter."



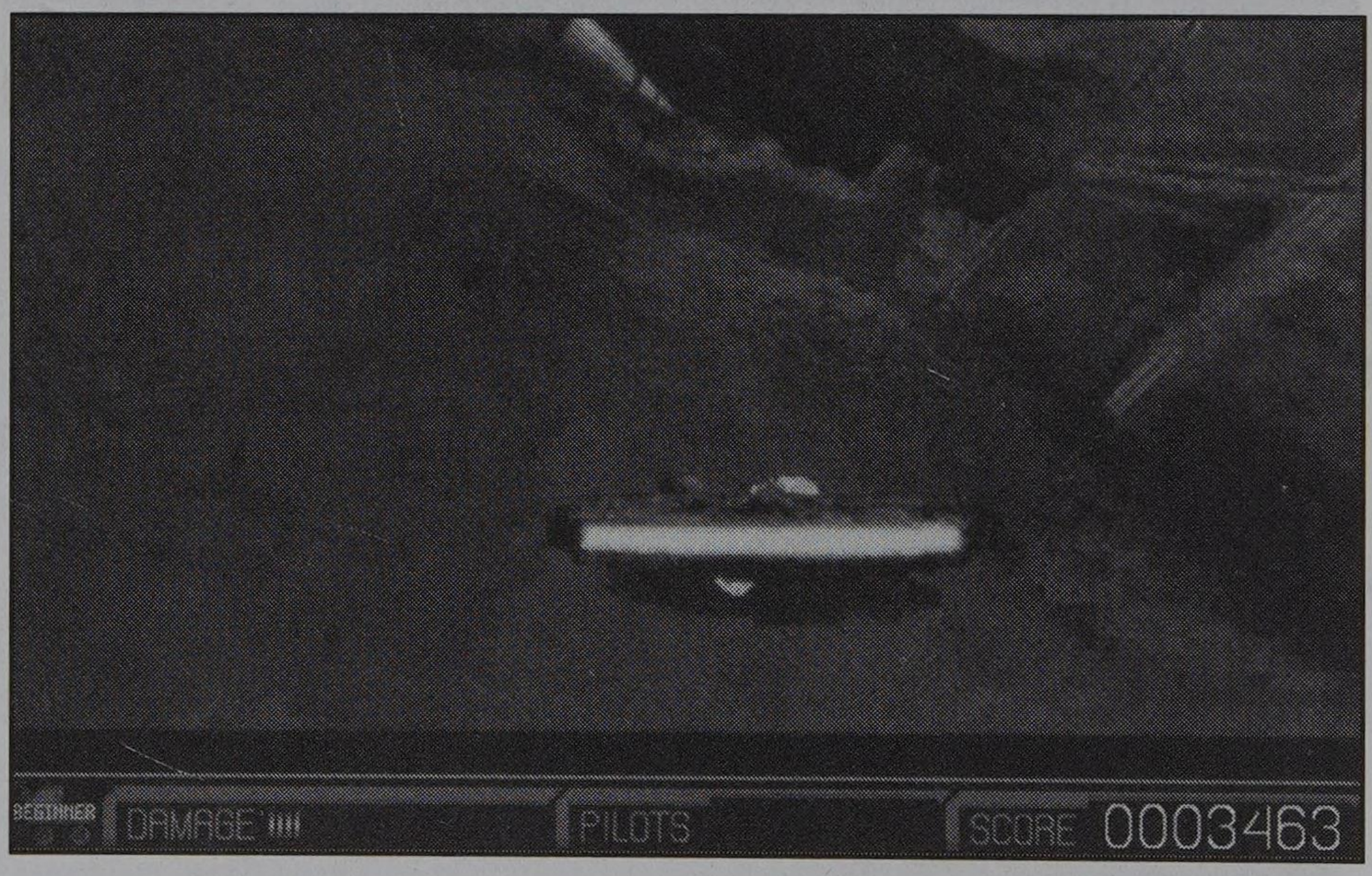
Stage 1

Try to keep your ship in the center of the screen, or somewhat centered, for this stage. There's no firing to be done, so you can focus exclusively on staying centered. It's especially hard to keep centered on the harder difficulty settings because there is more drift. On the Expert setting, you are really pulled on the turns and must compensate by pushing the other way.

— Sean Matheis

For the pipe sequence, stay centered in the upper-right-hand corner — that's where less struts are, where the pattern opens. If you go anywhere else, you will hit the struts and take on damage.

— Chris Snyder



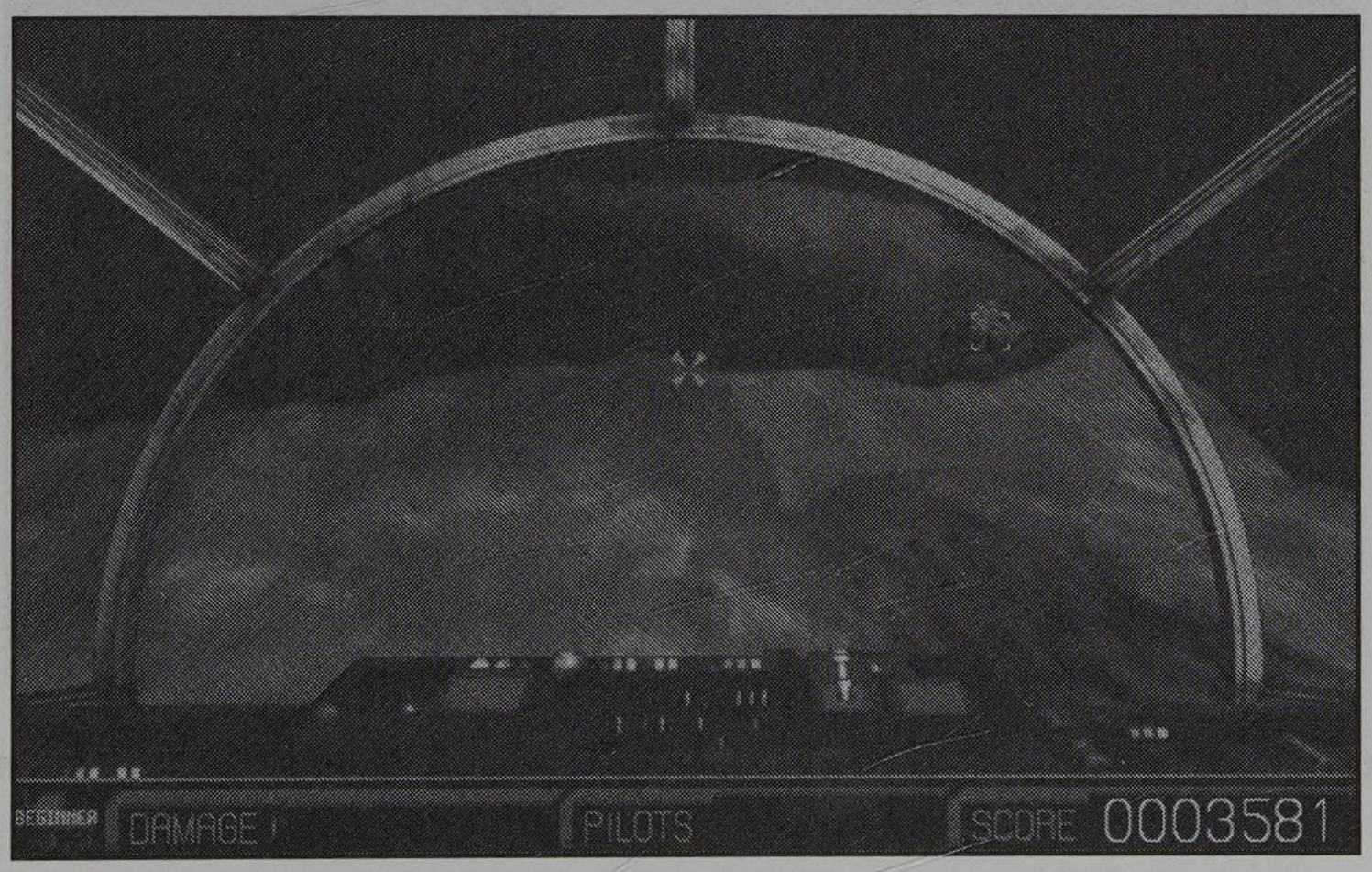
This is the toughest part: You're flying level and suddenly bank, which pulls you hard to the left. The temptation is to keep your ship center, but don't do that — pull right and up, opposite the way you're going. That will put you under the strut and away from the wall — two frequent misfortunes.

— Albert Chen

Stage 2

Right at beginning are two hoversleds that will shoot at you. The key is to take them out as fast as possible, before you reach the pistons. Otherwise, they will constantly pester you, and you must concentrate on both flying and shooting. The best time to take them out is when they're bunched — one shot can take them both out.

— Brad Grantham



After the pistons, there's a sharp bank to the right, then another hoversled. It's possible to take it out just as you go into the bank. Line your cross-hairs along the right wall and wait for it — but don't stay right too long or you'll auger into the wall.

— Brad Grantham

Now you're heading down. The targets coming at you won't hurt you so you don't have to shoot them, but you can shoot them for points. It's easiest to take them out as soon as you reach the tunnel-track area.

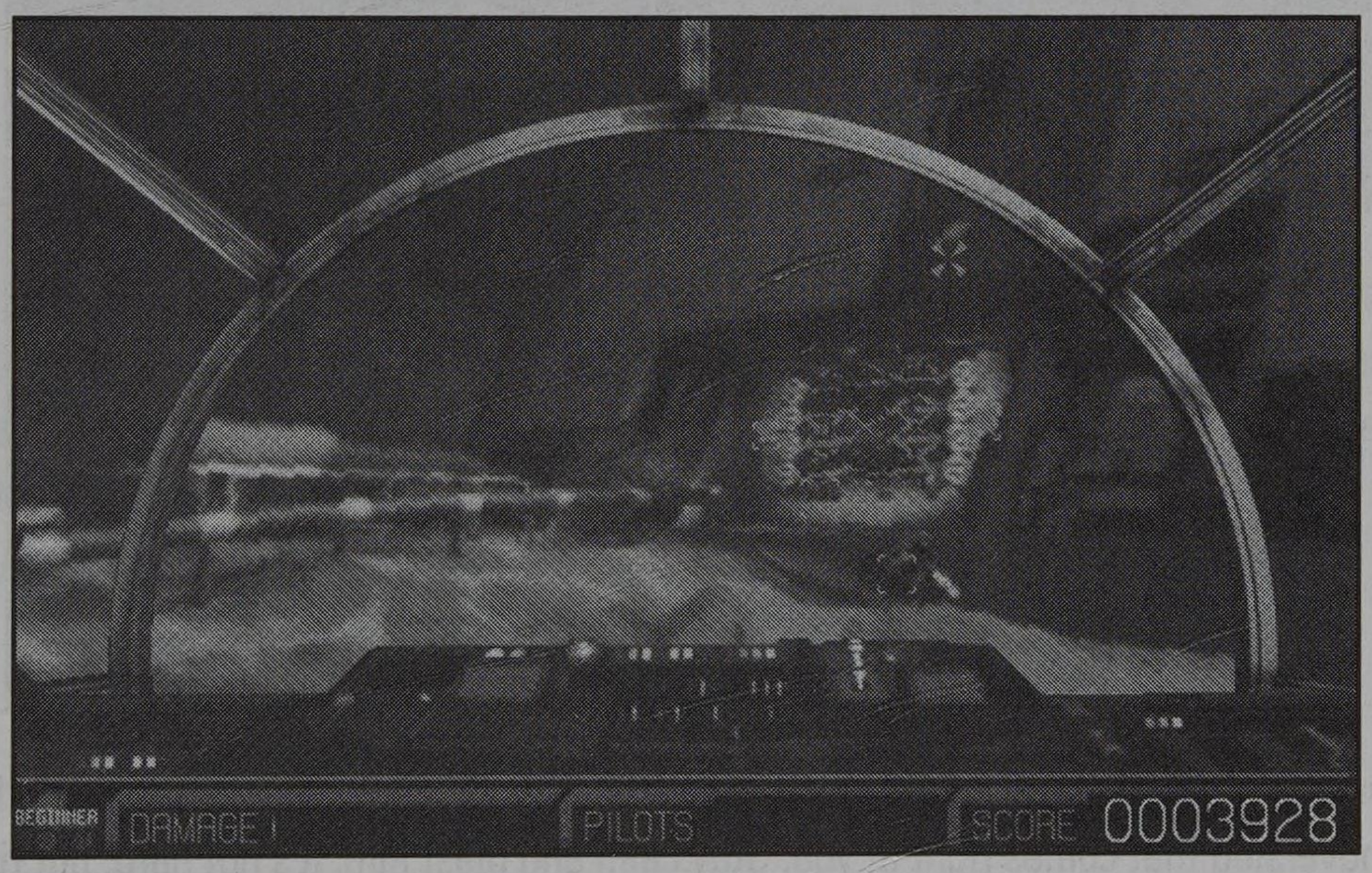
— Brad Grantham

Right after the tunnel tracks, as soon as you see blue ground, get ready to make a sharp turn to the left.

— Brad Grantham

When you reach this open area, just before the first tunnel, you'll see a hoversled in the upper middle of the screen. You can't tell what it is until you're close — but you want to take it out before you see what it is. Bring your aim up and zap it. Don't worry about the targets on the tram rails — they can't hurt you.

— Albert Chen



In the first tunnel are two red dots or buttons on either side of the door. You must take them out to turn off the force field or you will crash through and take on damage. The trick? It's harder to shoot the right one out because you see the left one first. So as soon as you see the left one, take it out, and then turn to better view the right one.

— Sean Matheis

You find the same two buttons at the end of the tunnel. You must hit them to remove the force field. Because you come straight on, it's easier to hit them.

— Sean Matheis

Enter tunnel two. Another force field, another two buttons. Once you get by the field, there's another hoversled that comes right at you. Stay calm and blast him. It's not hard, but right after you do him in, pull up hard to go up the shaft.

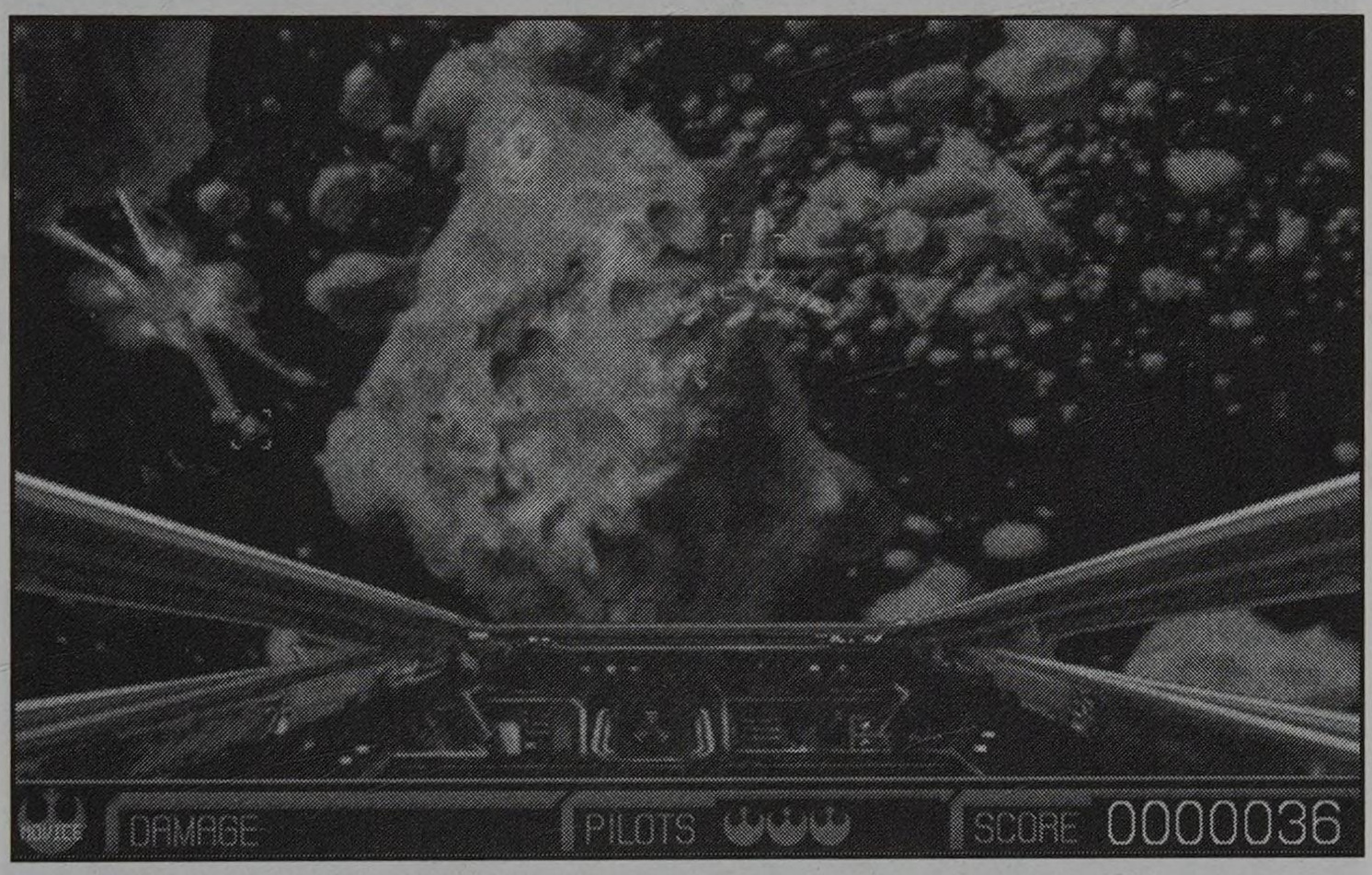
— Chris Snyder

This last area resembles a shutter on a camera. The "shutter panels" close in a definite pattern. To beat this gauntlet, fly to the lower left on the first gate, then up, then to the lower right, then down the middle, then left, then to the upper right — and finally you're through.

— Matthew Azeveda

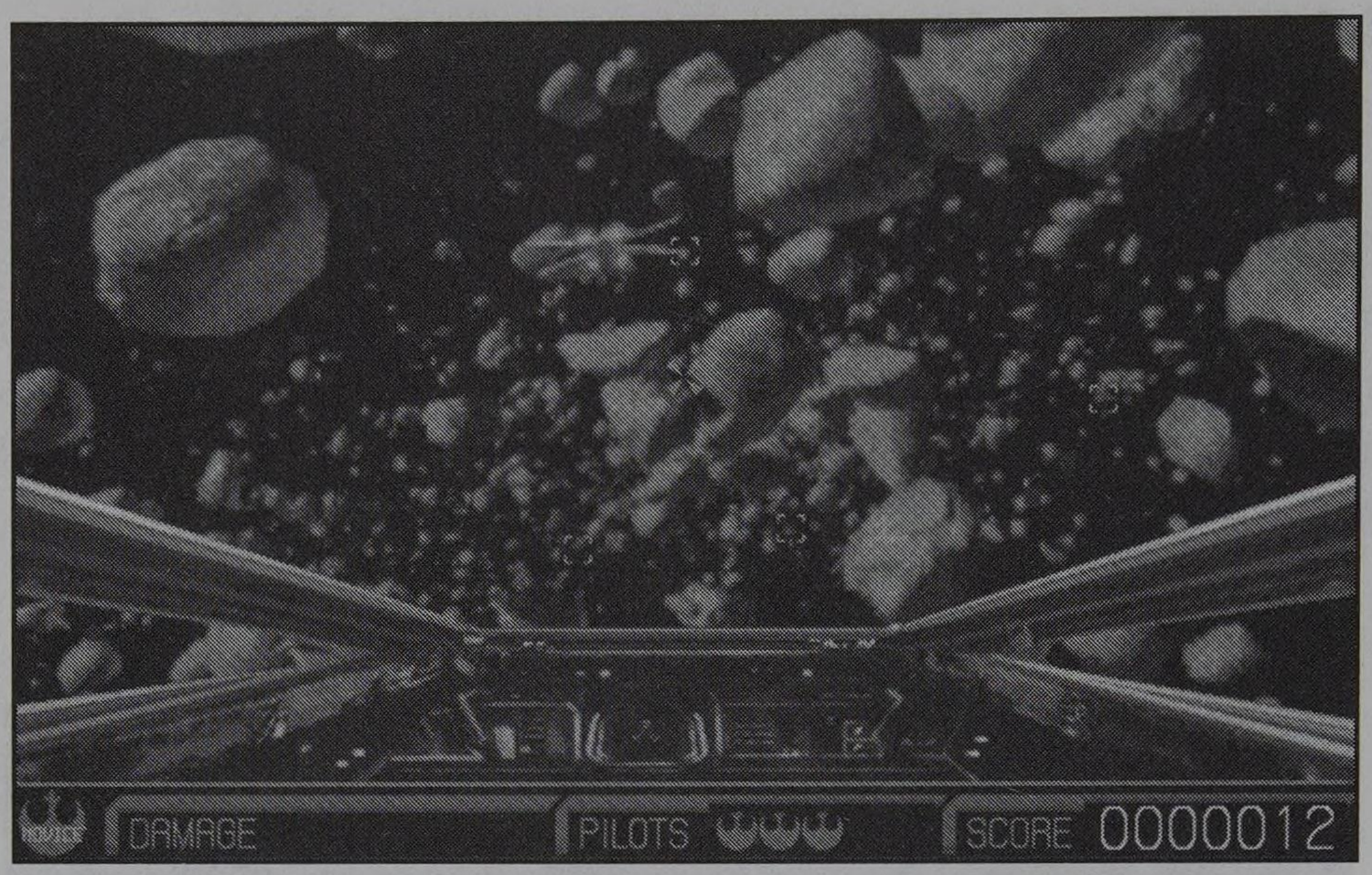
CHAPTER 4: THE ASTEROID FIELD

This is probably the most realistic asteroid field ever created for a game. The testers love to play this chapter because the flight path is so soothing, and its perfectly synchronized to terrific music. It's a long, long flight with a cockpit view, and the goal is to avoid the asteroids and shoot the mines. The mines don't fire at you, but if you let them get by you, you take on damage. This field is much more fun than the ones in *Rebel I* because you have much more control and the asteroids are much bigger — you can actually avoid them. All in all, as Rascal Three says at the end, this chapter is "a lot of fun. I had a ball."



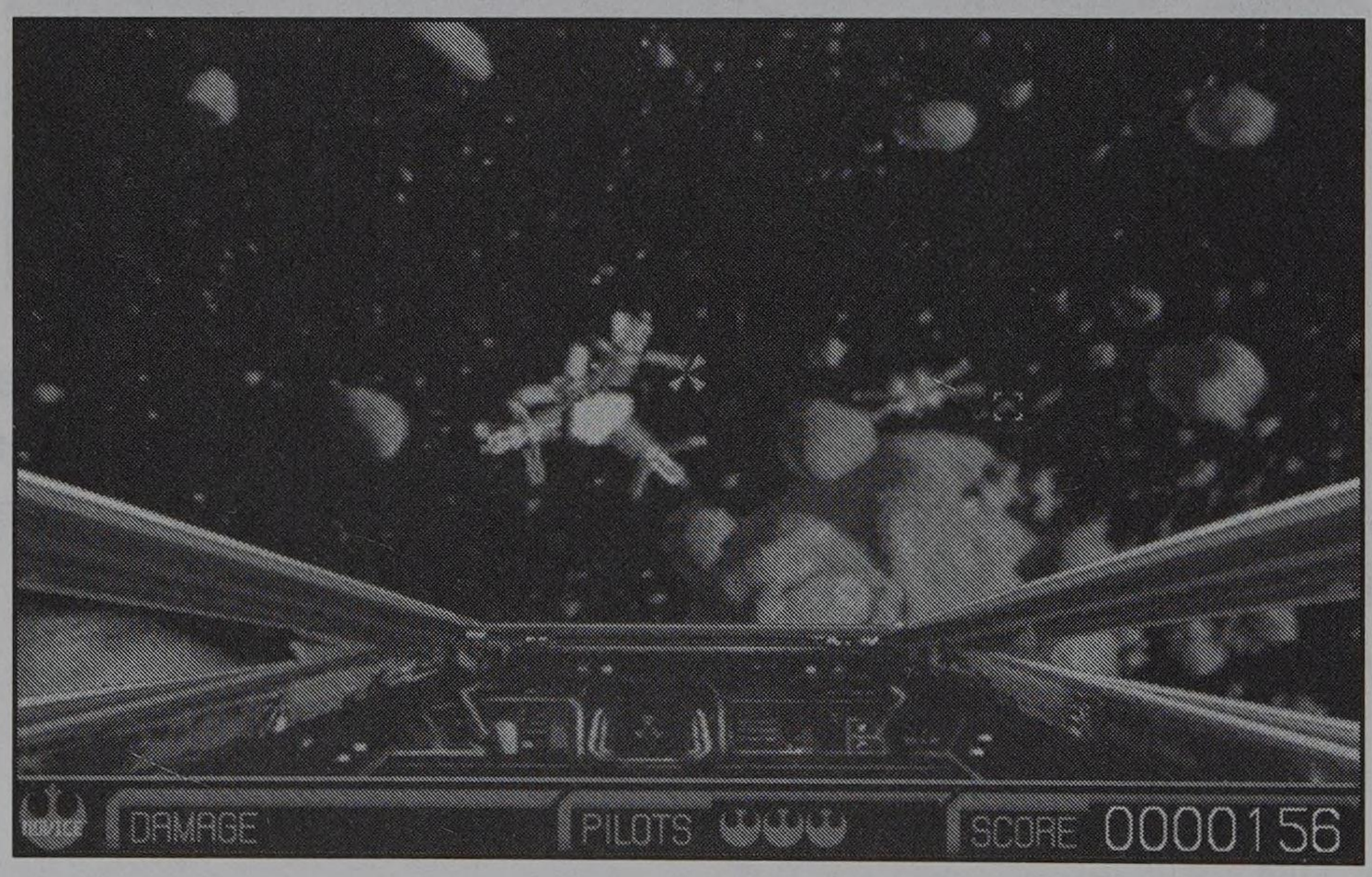
To avoid the asteroids, learn the the flight path. That's a trial and error process, but there's no section that is extraordinarily tough. Pay close attention to the movement and direction of the asteroids — then adjust your direction to move around. Essentially whichever way they go, you go the other way. It's very intuitive.

— *Albert Chen*



Try to shoot the mines from as far away as possible, and notice that when the mines lock onto you, they waver left and right in an almost circular motion. This gives you time (just a few seconds) to destroy them before they bang into your ship.

— Chris Snyder



There are several blue mines that are attracted to you like magnets. Get them before they get to you. Only be concerned about the mines that lie directly in your flight path. The ones on the left and right sides can't harm you — they're just for points.

— Matthew Azeveda

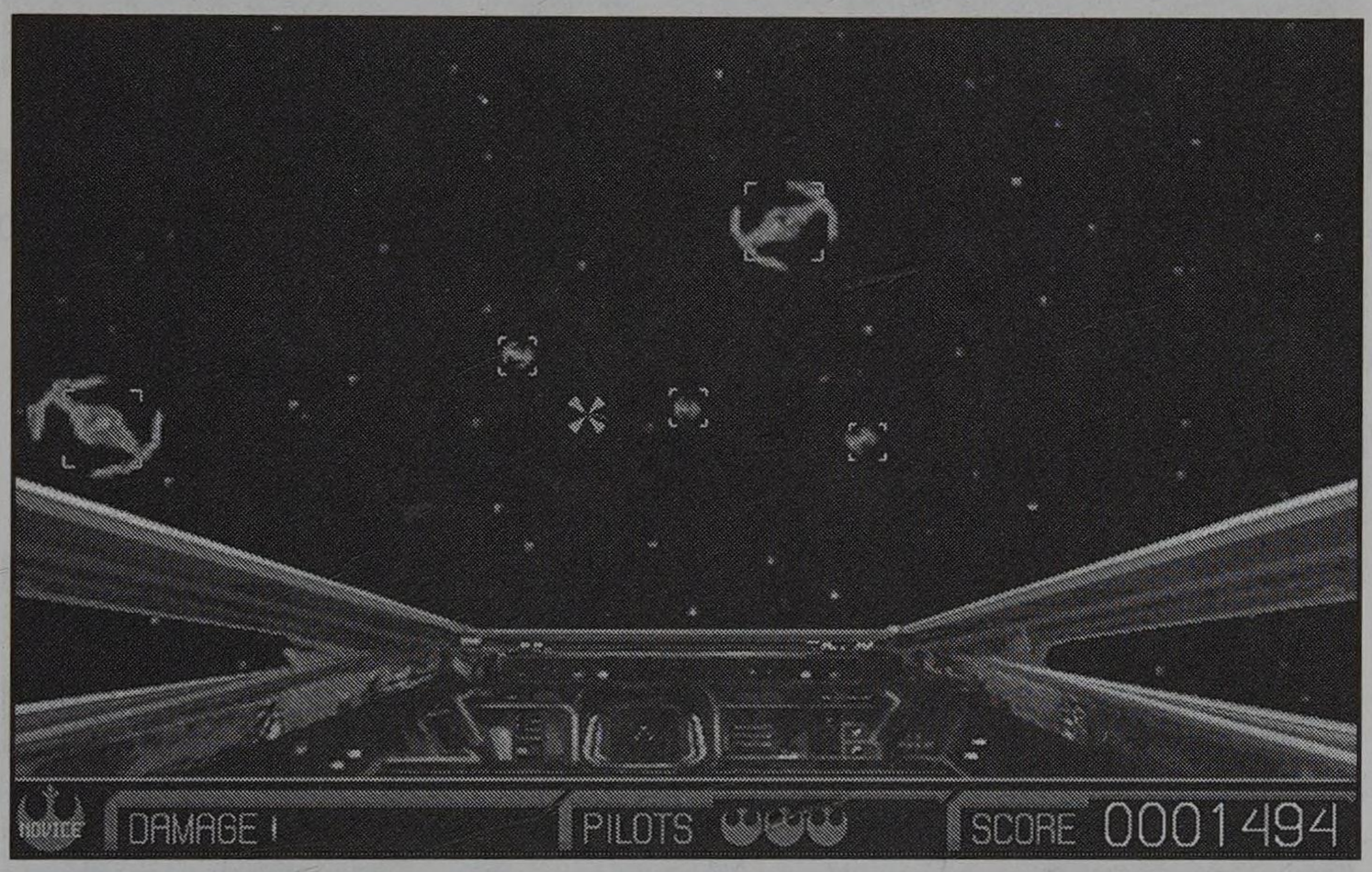
It's helpful to listen to the instructions from your lead. When he says "pull up," do so. When he says, "watch your starboard side," you can. But don't swear by these guides — sometimes they're dead wrong.

— Matthew Azeveda

CHAPTER 5: INTERCEPTOR ATTACK

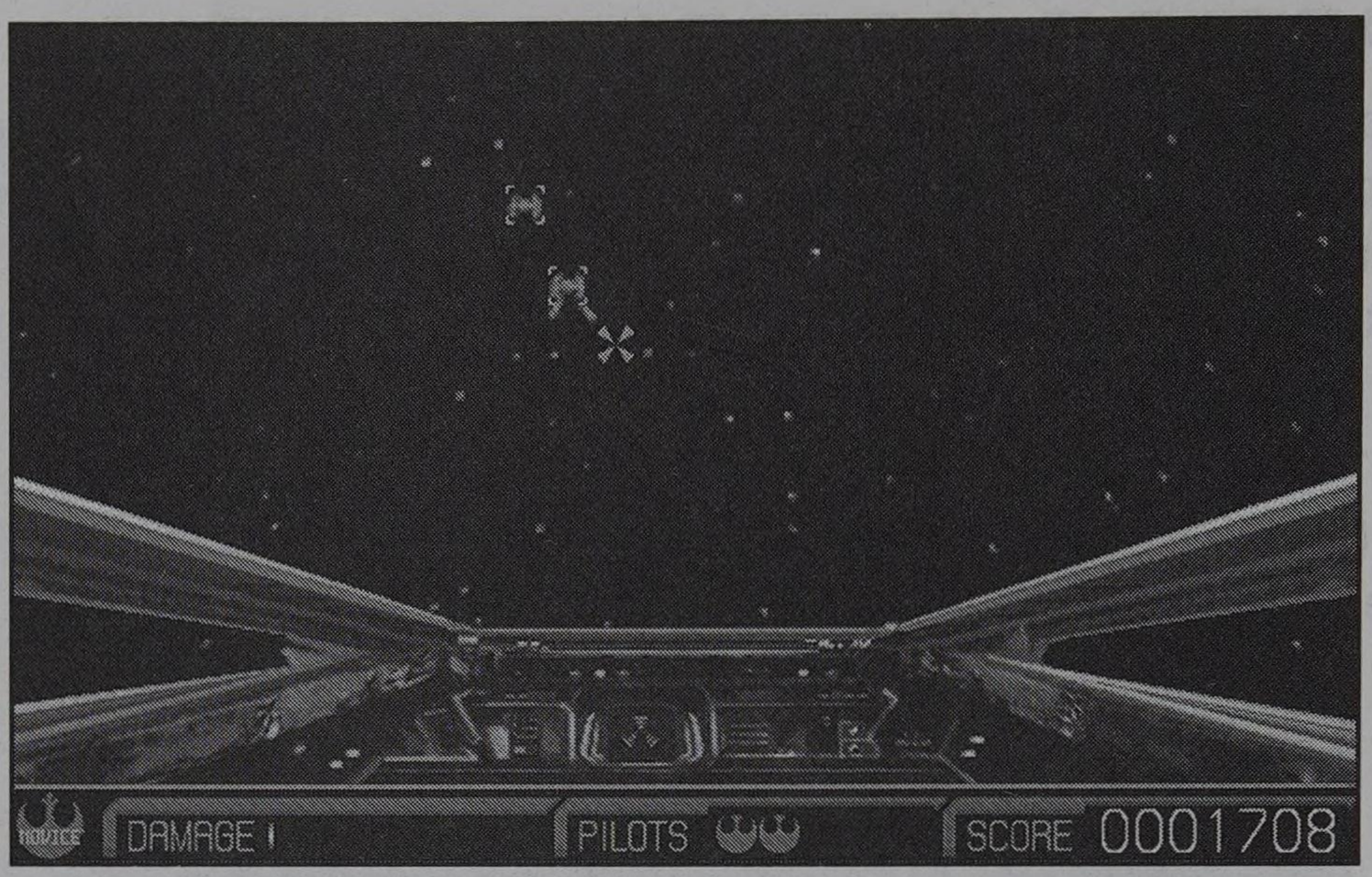
Into the cockpit once more for a true shooting gallery, you against hordes of TIE interceptors. This chapter is very similar to Chapter 1, and the same flight guidelines apply. Some people find it's easier to use a mouse on this level, but that seems out of character. A fighter jock should have a stick in their hands, don't you think? The goal is simply to zap TIEs fast and often — and never let them pass you by.

If you're using a joystick with a 486 or slower-speed Pentium machine, set the joystick setting to 5 (instead of the default 3) — it gives you more whip, tighter control, and a quicker response.



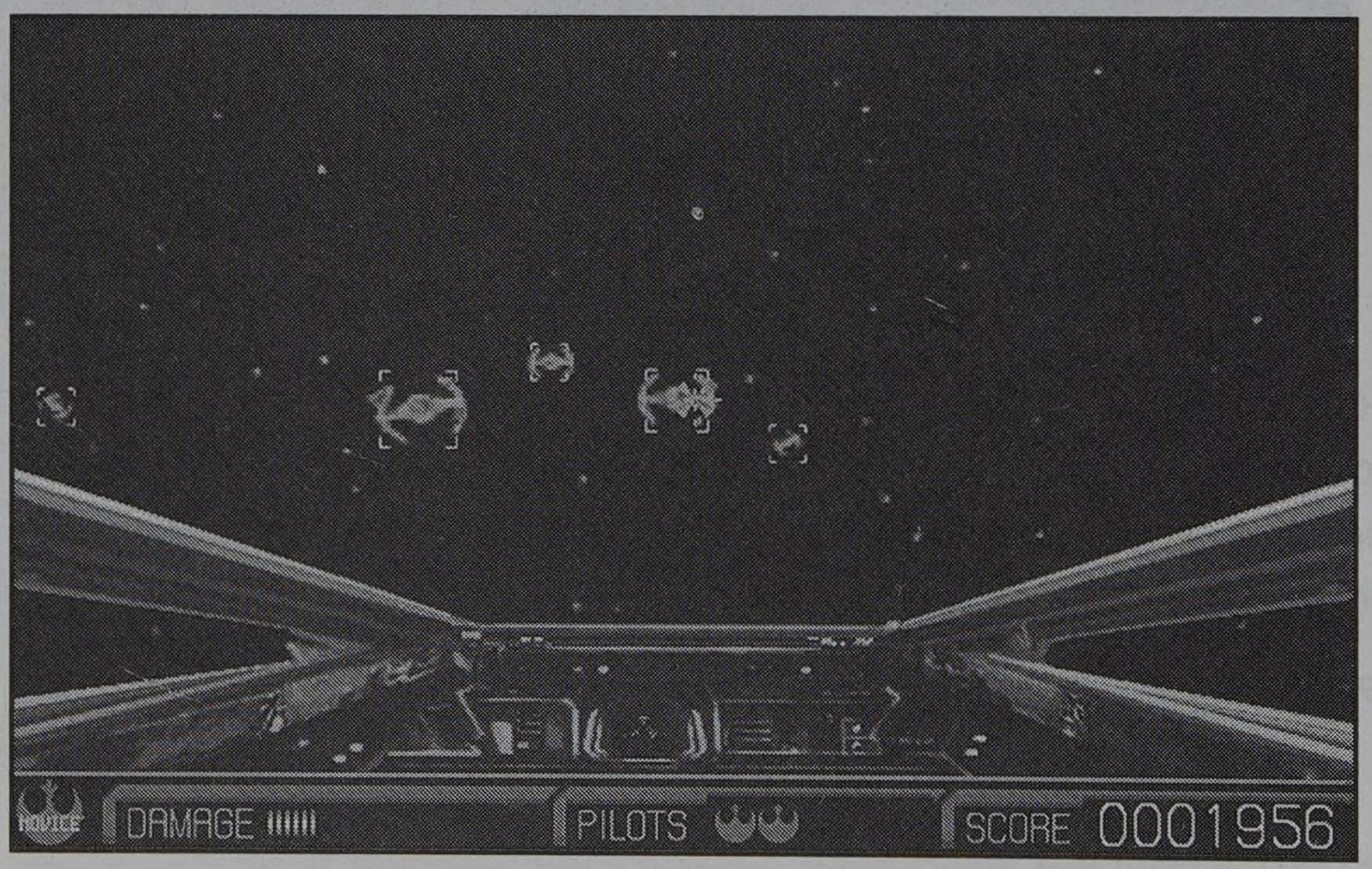
A key to quick destruction of the TIEs is to turn on Rapid Fire. This does not mean keep the trigger down the whole time while tracking your opponent, but use efficient bursts to wipe out the bogies. You can lead them a bit, so use this to your advantage. If you keep your cursor in the middle of the screen as much as possible, you can get to the edges more quickly.

— Sean Matheis



Shoot the TIEs when they're far away so you have more time to think and react. It's also easier to destroy multiple fighters with single bursts when they're further away. Whatever you do, don't let them fly by you because that gives you major damage. If just two fighters get past you on the Expert setting, you're dead.

— Albert Chen

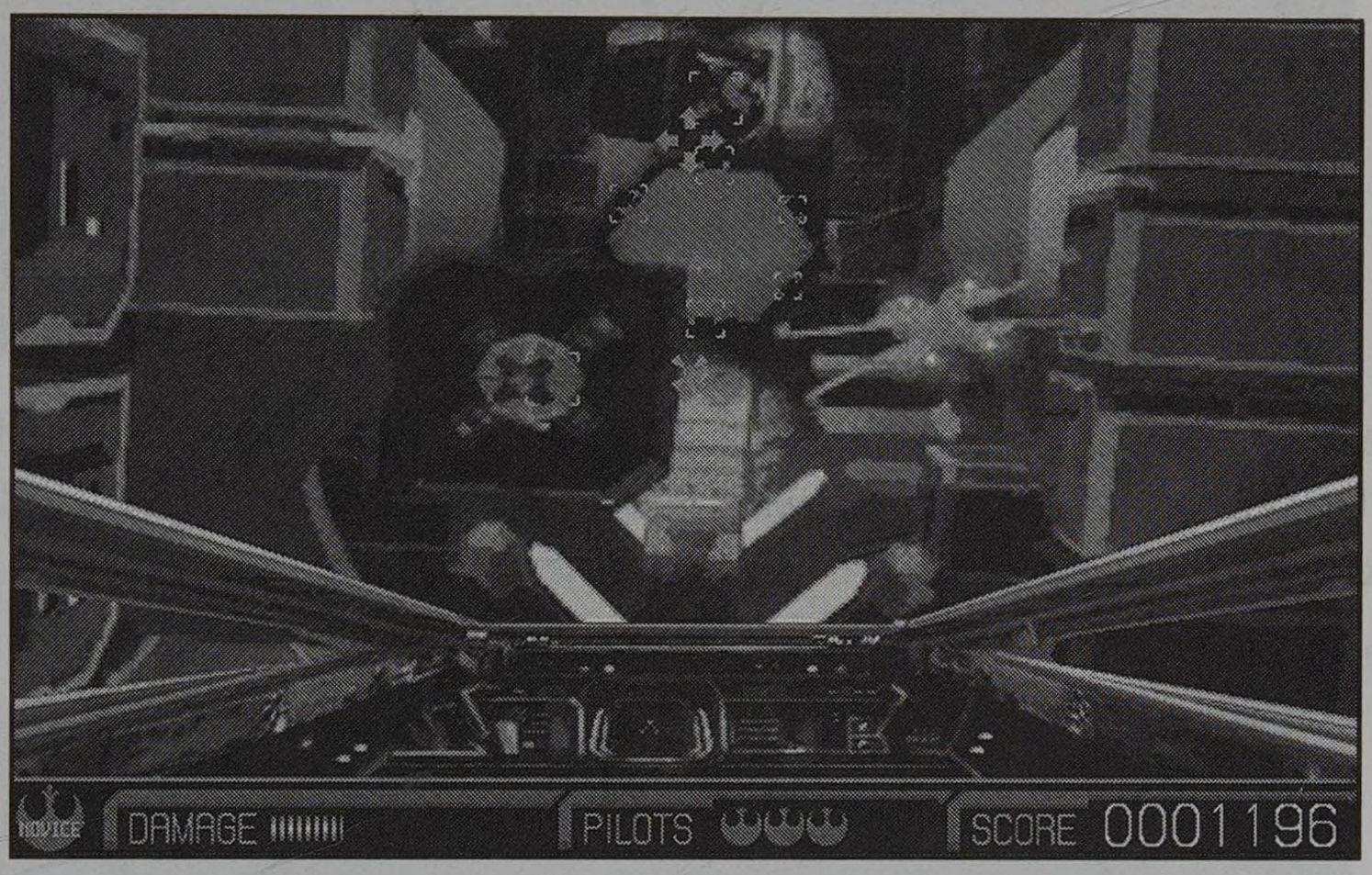


Try to stay locked on one target at a time until you get it. If you don't finish one off, he'll just come back to haunt you — and perhaps fly past you while you're busy with someone else. You eventually get swamped with too many for you to handle. Stay calm and destroy one at a time even if it takes you a little while.

— Chris Snyder

CHAPTER 6: THE MINING FACILITY

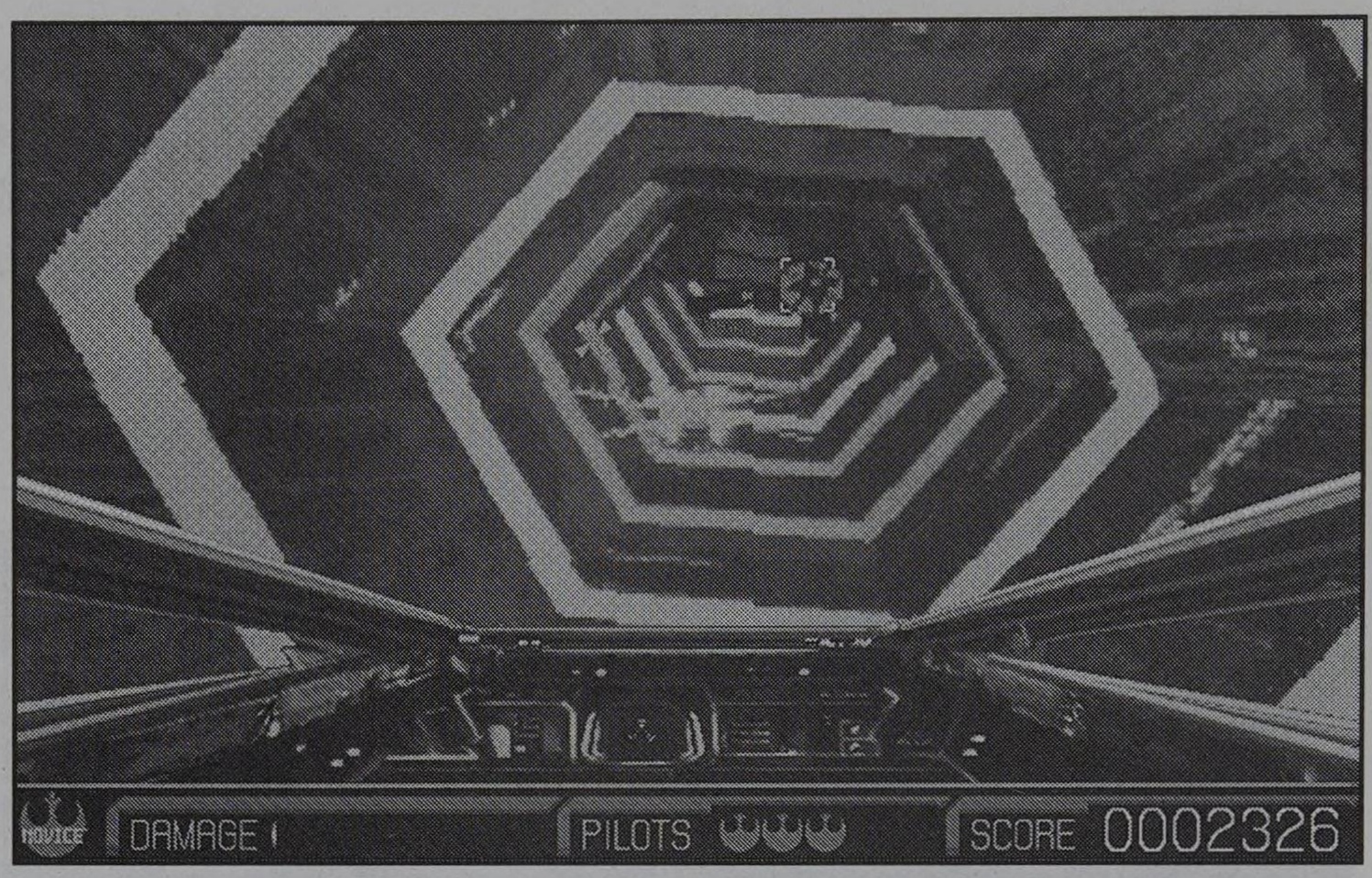
This is a two-stage, cockpit-view level with lots of action, mostly from gun turrets. One thing you should know about these turrets: Not every gun in a section fires at you. In fact, it's usually just one gun per section. With practice you'll know which guns fire at you — and those are the ones you want to target first.



Stage 1

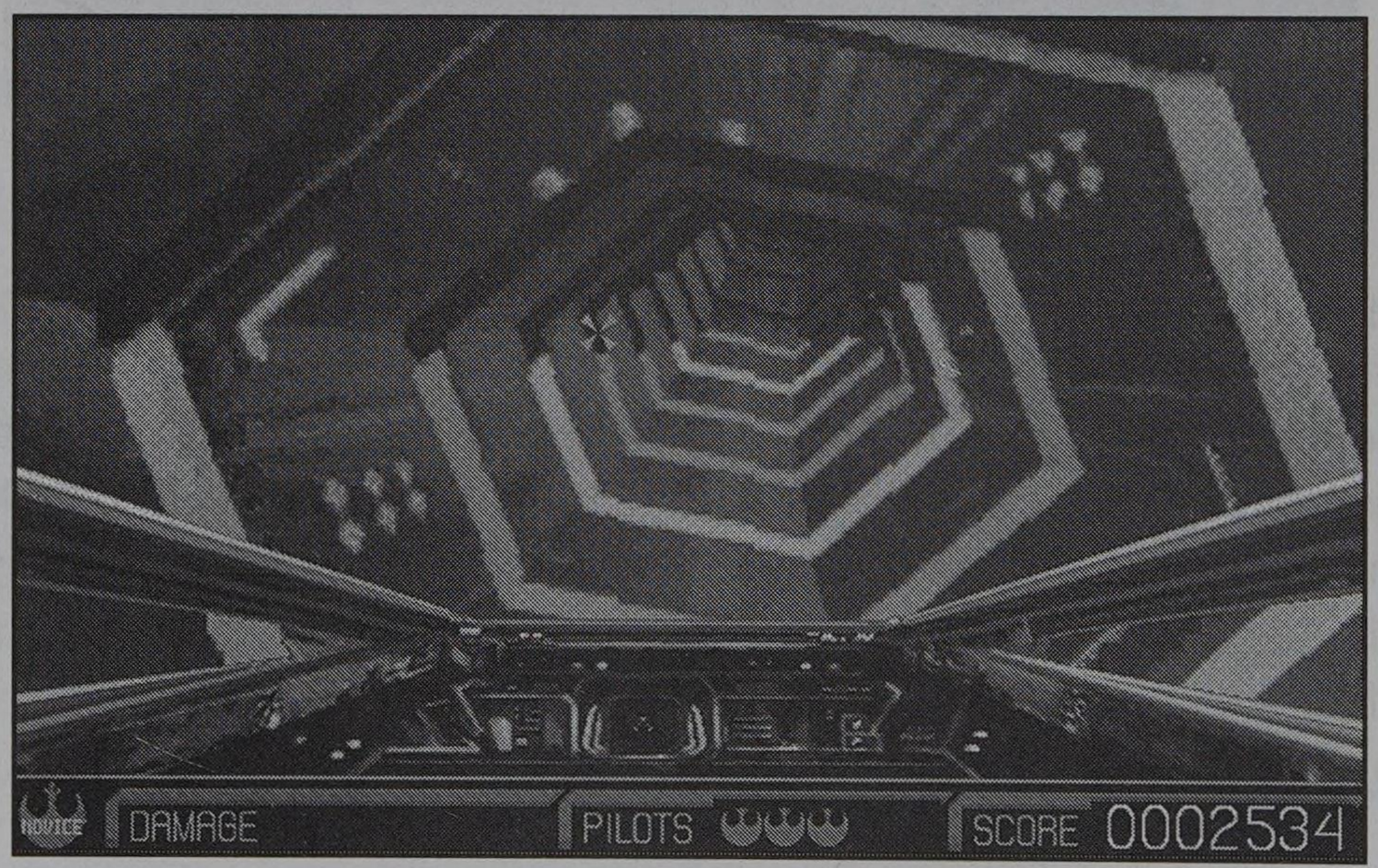
The first part of this chapter is a loop. You're in a hexagonal tunnel, and your goal is to knock out six shields on any one of the three different force-field generators in to move on. In the meantime, these cargo drums are firing at you. It's easiest to knock out the shields of the first generator because it's less cluttered than the other two, and you can briefly shoot at them far away. On the Beginner and Novice settings, it's possible to get these shields on the first pass. On Standard and Expert, it's more difficult and your aim has to be first rate. It usually takes two or even three loops.

— Matthew Azeveda



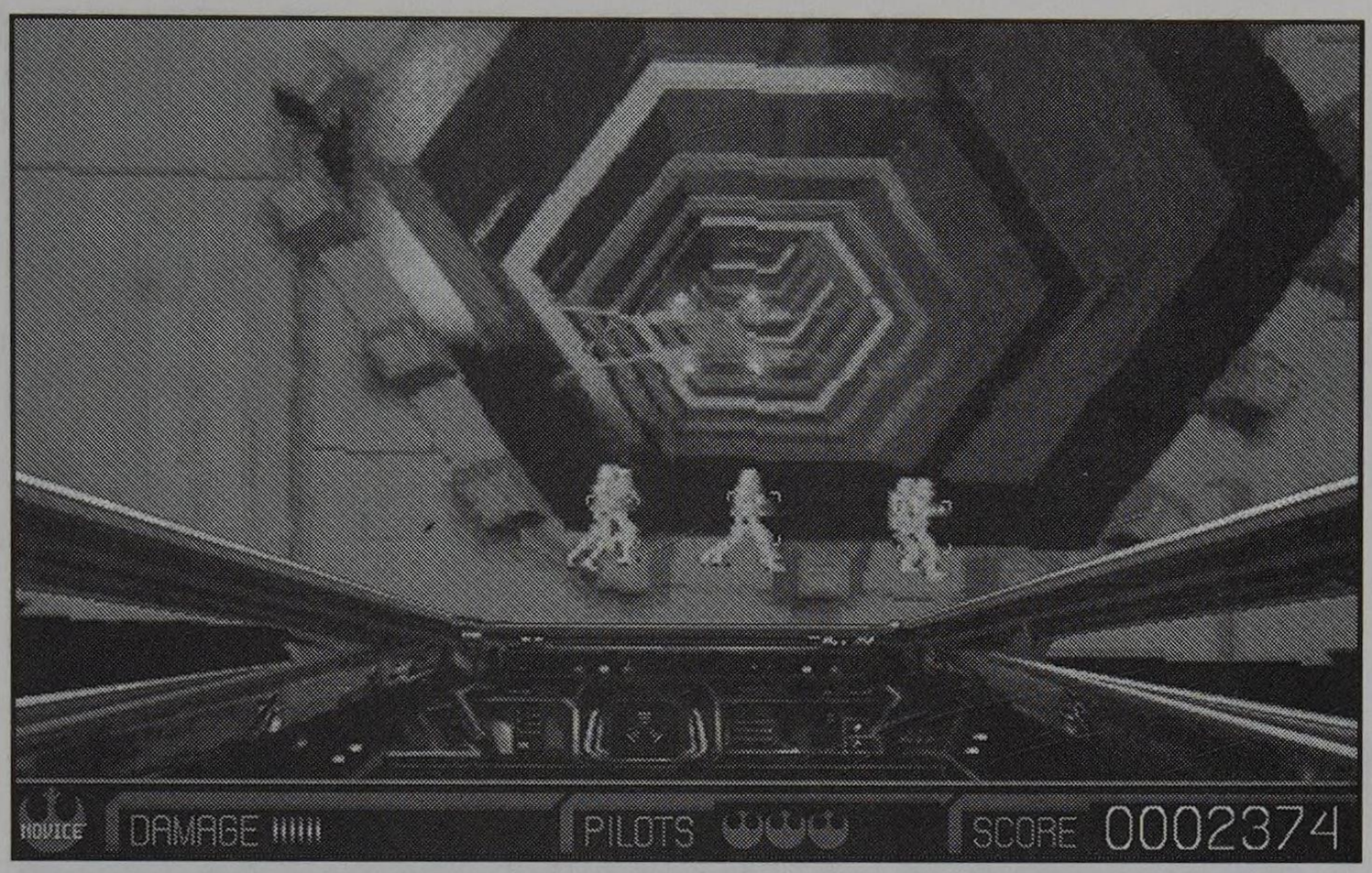
There are some round guns that fire at you in this loop — if you take them out on the first go-around, they can't get you anymore. You will loop five or six times in this area, if you don't get the shields, before you automatically move on to the next stage.

— James Evans



This loop is a good place to heal yourself. As you knock out drums and guns, your damage level will go down, so go ahead and loop a few times. You lose some time bonus points, but you can get enough points to grab an extra life here. Just remember to hit the cargo drums on each loop because some regenerate.

— Chris Snyder



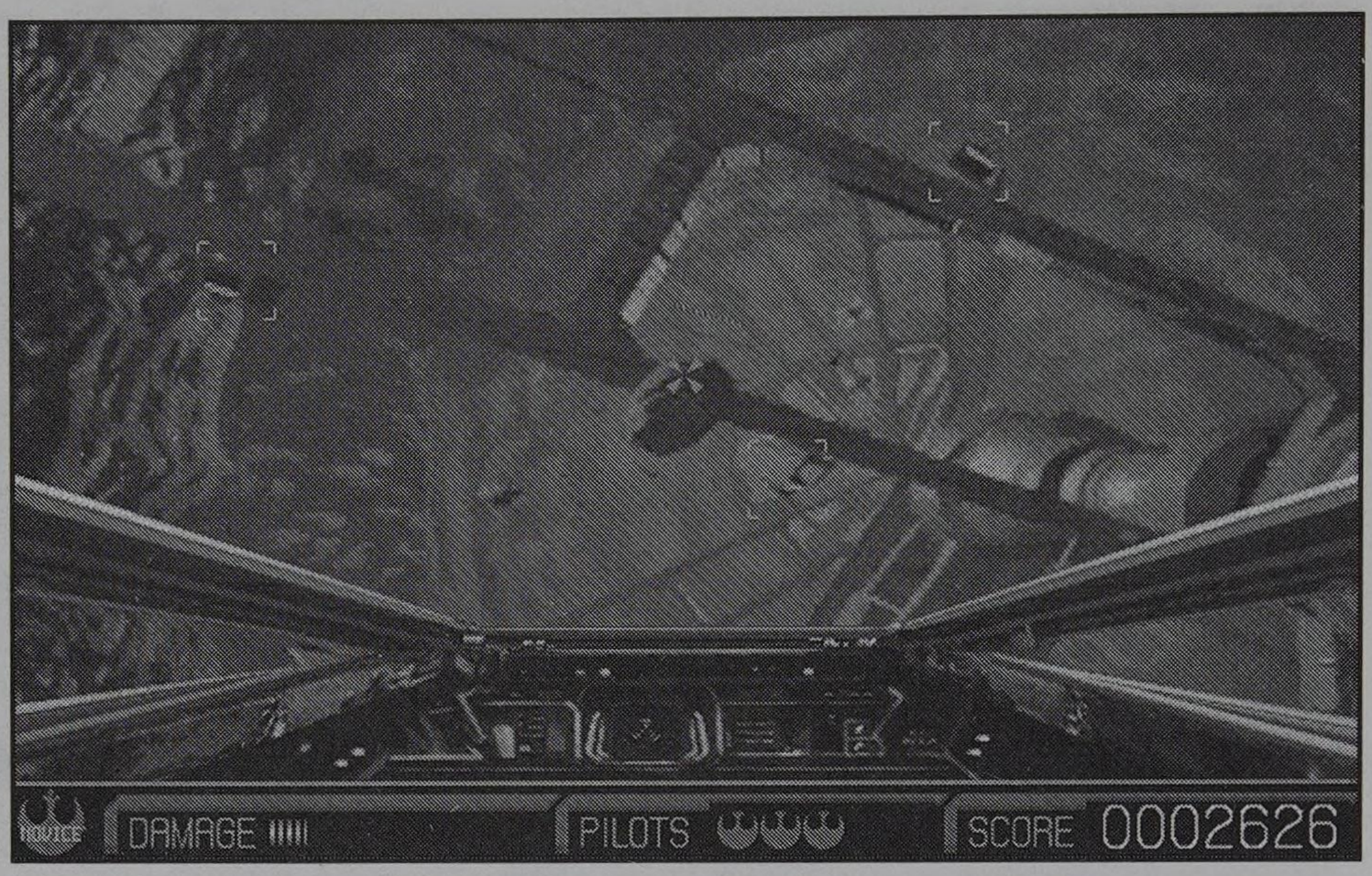
See those stormtroopers walking across the catwalk? They can't hurt you, they won't fire at you — but you can take them out for points.

— Chris Snyder

Stage 2

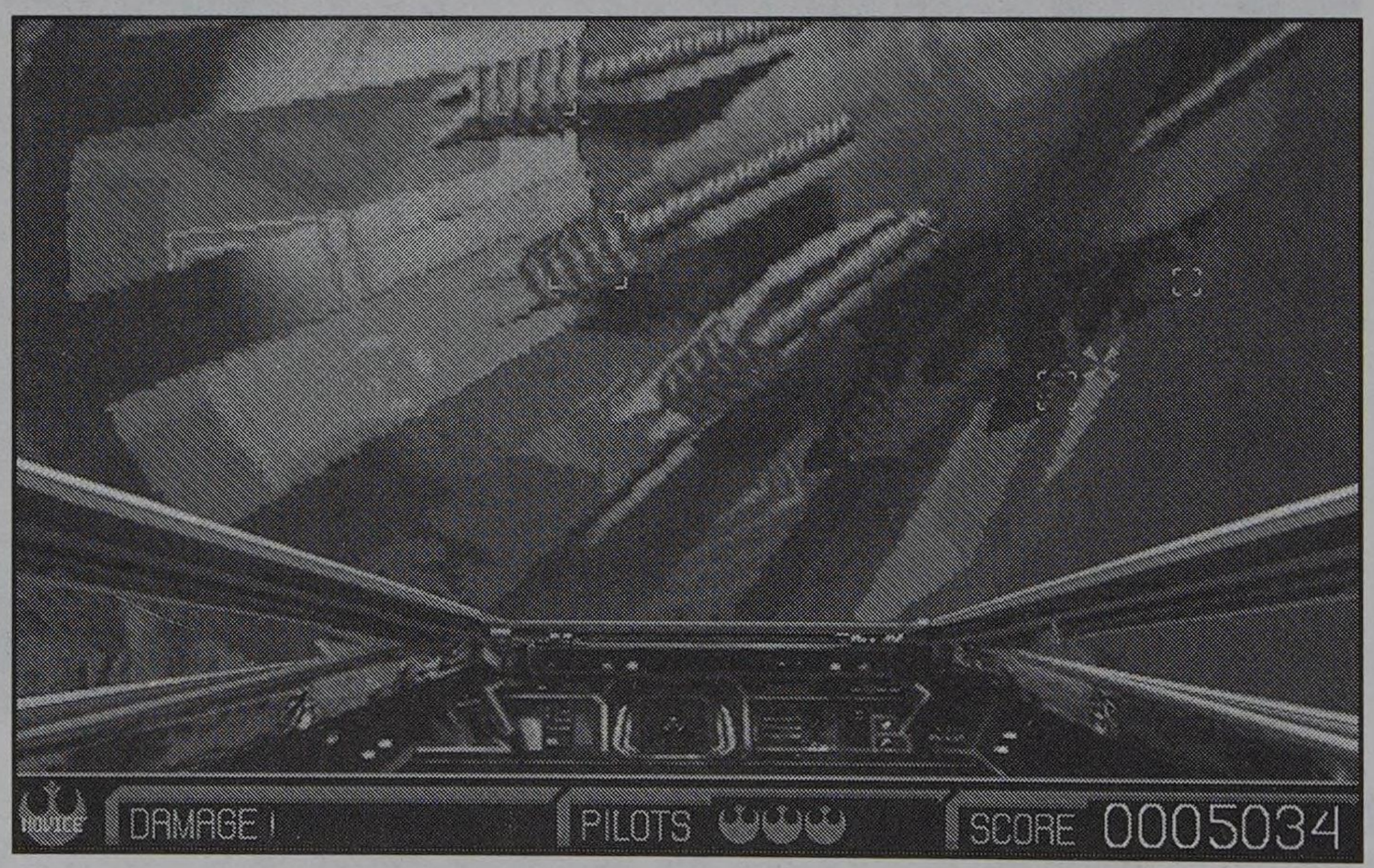
Sentry guns are the main target in this stage. You want to destroy the guns closest to you because they will damage you if you go past them. You can follow the signals of your lead to good advantage.

— Chris Snyder



There's definitely a pattern here. After your lead says, "Watch out for those excavators," two boulders come at you. First move left, then hard right, then down, then up, then to the upper right where you take out two guns. When the path pulls you hard to the left, keep your ship to the right to avoid some struts. Finally, pull up then dip down to fly under a moving arm — from there on it's pretty easy.

— Matthew Azeveda



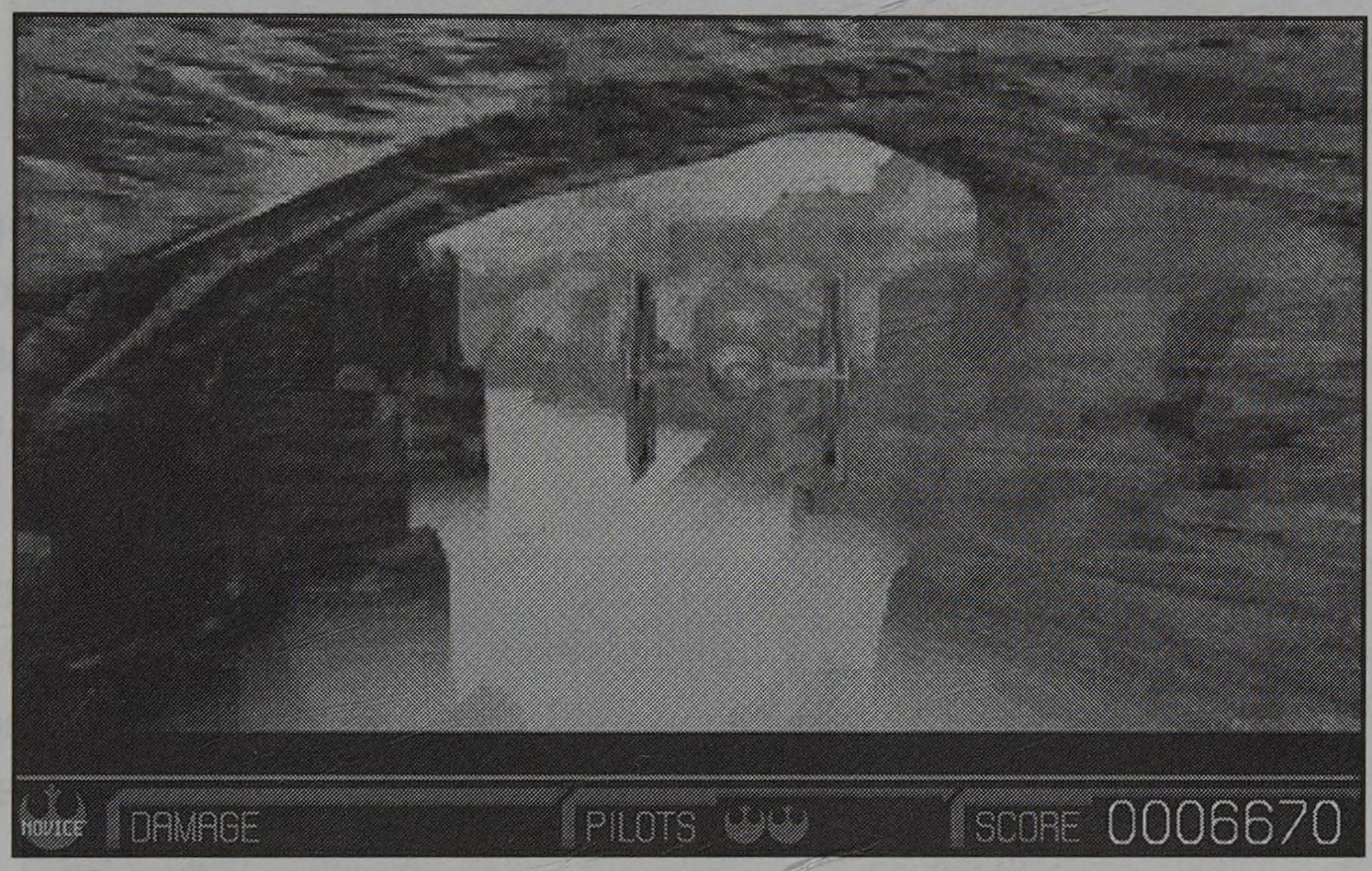
You can take out one or two guns before you reach the escape exhaust vent. You don't need to take out all the shields on this vent, just enough to create an escape route. The trick is to target only the ones on the lower right. Just keep firing at them and you'll get all the ones you need. Then dive down to duck under one last strut and you're home free.

— Albert Chen

CHAPTER 7: TIE TRAINING

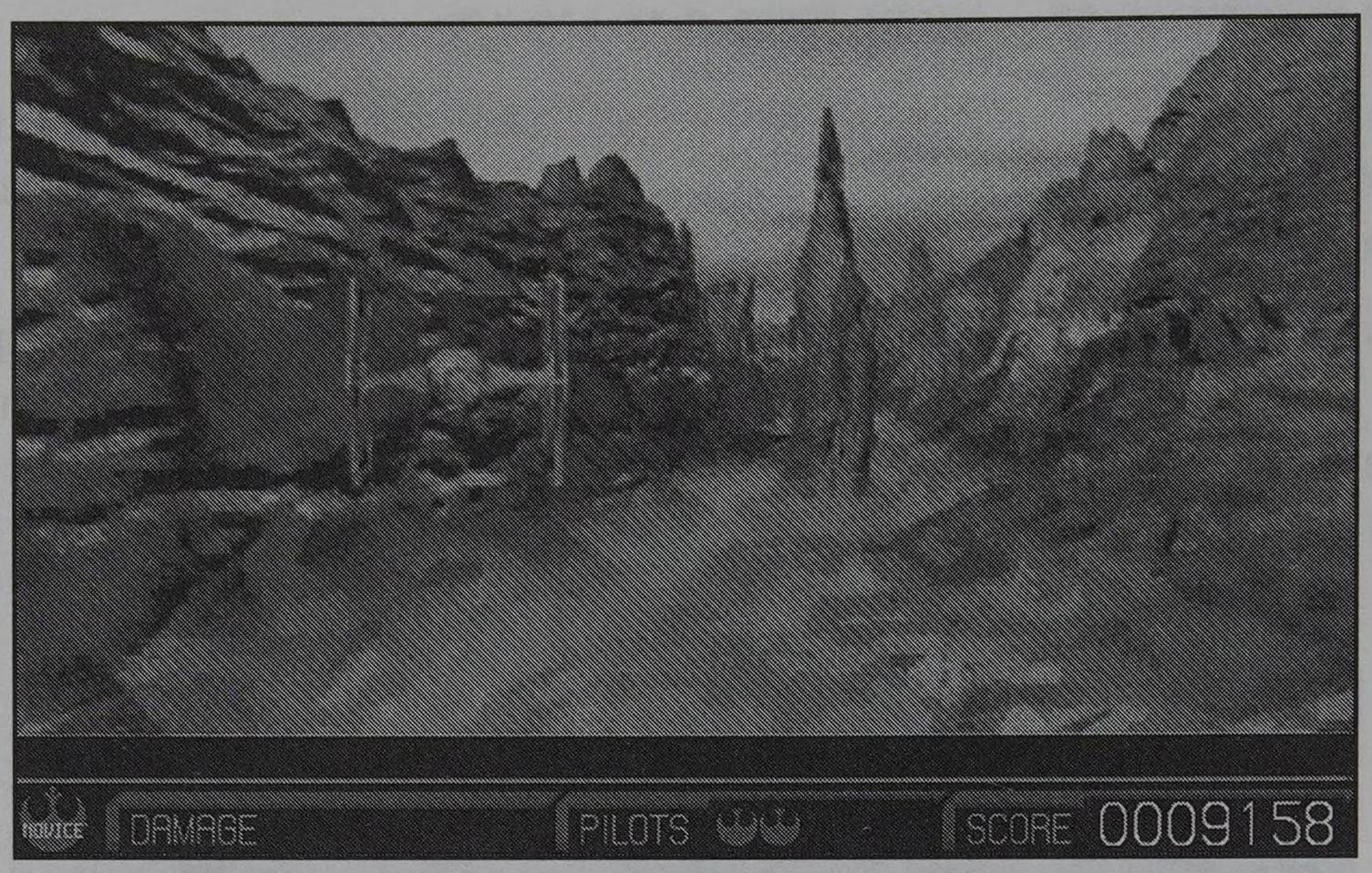
Shades of *Rebel I* here on this flight through Beggar's Canyon, but, oh, the canyon has become so picturesque. It's a long flight, but straightforward. The main thing is to avoid the rock walls — they inflict major damage.

The drift on the Standard and Expert settings for this level are very high, so you might want to adjust the joystick control to give you more sensitivity. It is very difficult to use the mouse on the higher difficulty settings. It requires even less movement than the joystick, with no quick jerks and no overcompensation.



How do you get through the canyon? As Han Solo said in *Return of the Jedi,* "I dunno. Fly casual." Really watch Admiral Krane in the TIE ahead of you. He's a hot-head (maybe related to Commander Farrel from the first *Rebel Assault*). Repeating his moves and making controlled movements will get you through the training. TIEs have no shields, so watch it. The key on this training run is, like Chapter 3, to keep your ship in the center of the screen. There is no need for any sudden movements; keep it tight. Whatever you do, don't overcompensate after sharp turns.

— Matthew Azeveda



When you come to the second foggy area, don't freak out as you start to climb. You might want to pull up — but don't. You don't have to do anything. Just keep your bird centered and you emerge just fine. After you break through, it's just patience from there on — the ride seems to go on forever.

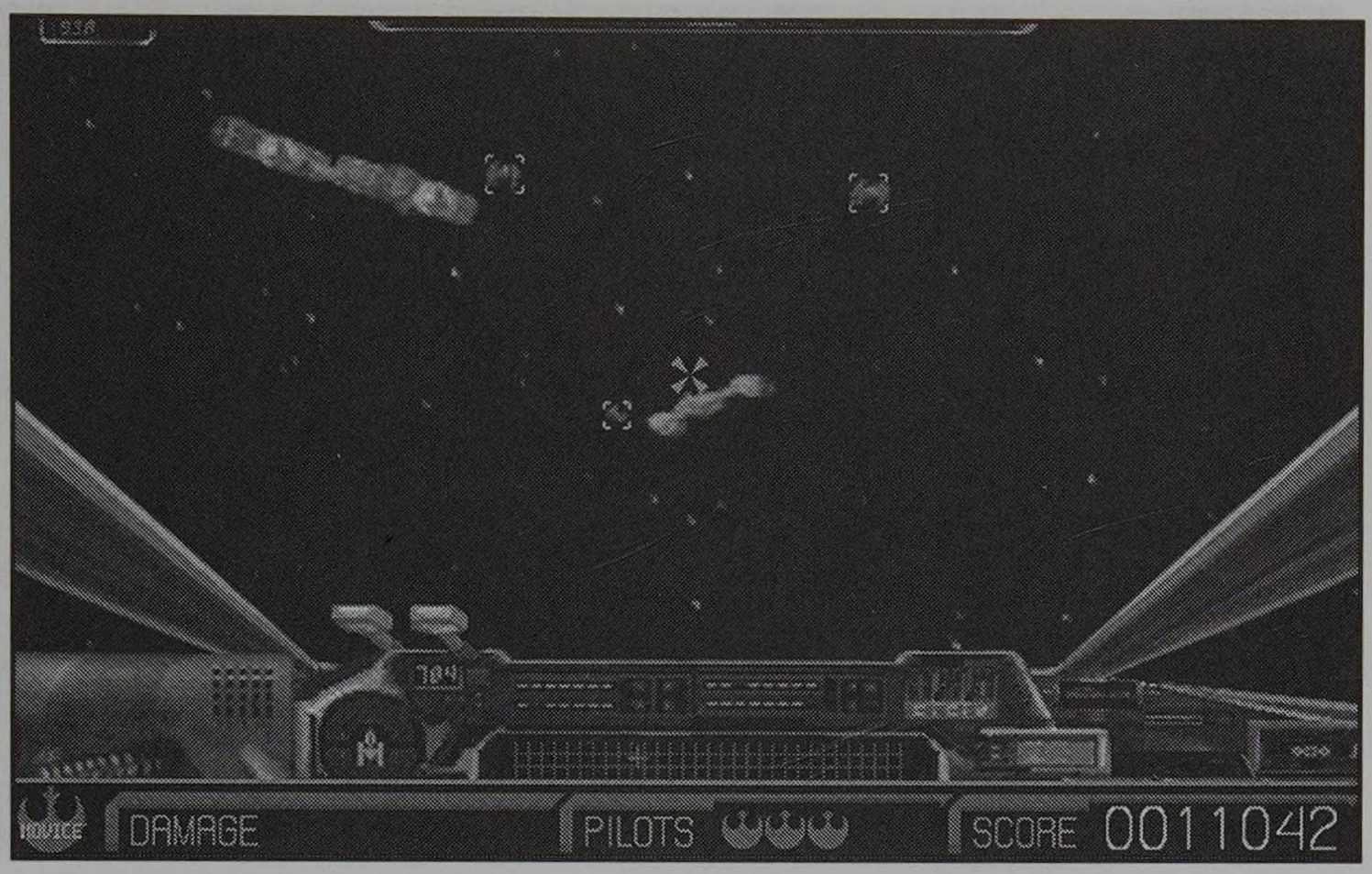
— Albert Chen

At the final fork, you have two choices. If you go right, you go solo, and it's pretty straightforward with no surprises — but you don't collect as many points either. If you go to the left, you follow Admiral Krane, and it's tougher, but not that hard. On higher difficulty settings, however, you want to watch the walls because there's little room for mistakes. If you strike a wall, you will bounce back and forth like a ping-pong ball between the tight walls.

— Chris Snyder

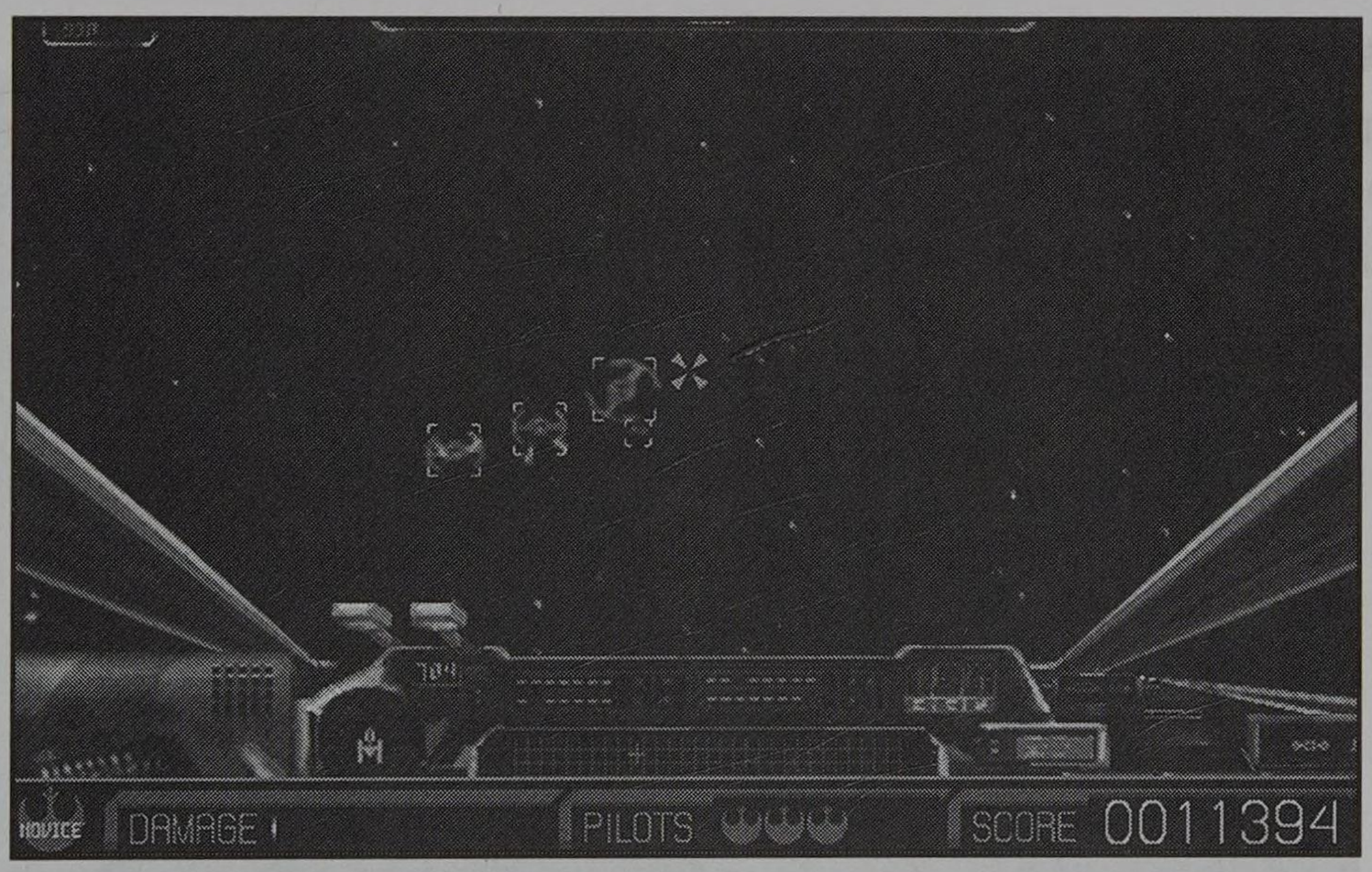
CHAPTER 8: FLIGHT TO IMDAAR

This rocky flight is one long shooting-gallery stage similar to Chapters 1, 5, and 14. You are in a Y-wing fighter battling interceptors once again. You must learn the pattern of the ships flying at you. Some move faster than the others, so try to pick these out and catch them before they fly past you. Remember, if a ship slips by, it inflicts much more damage than it does by its firepower. So no slip-ups, or slip-pasts.



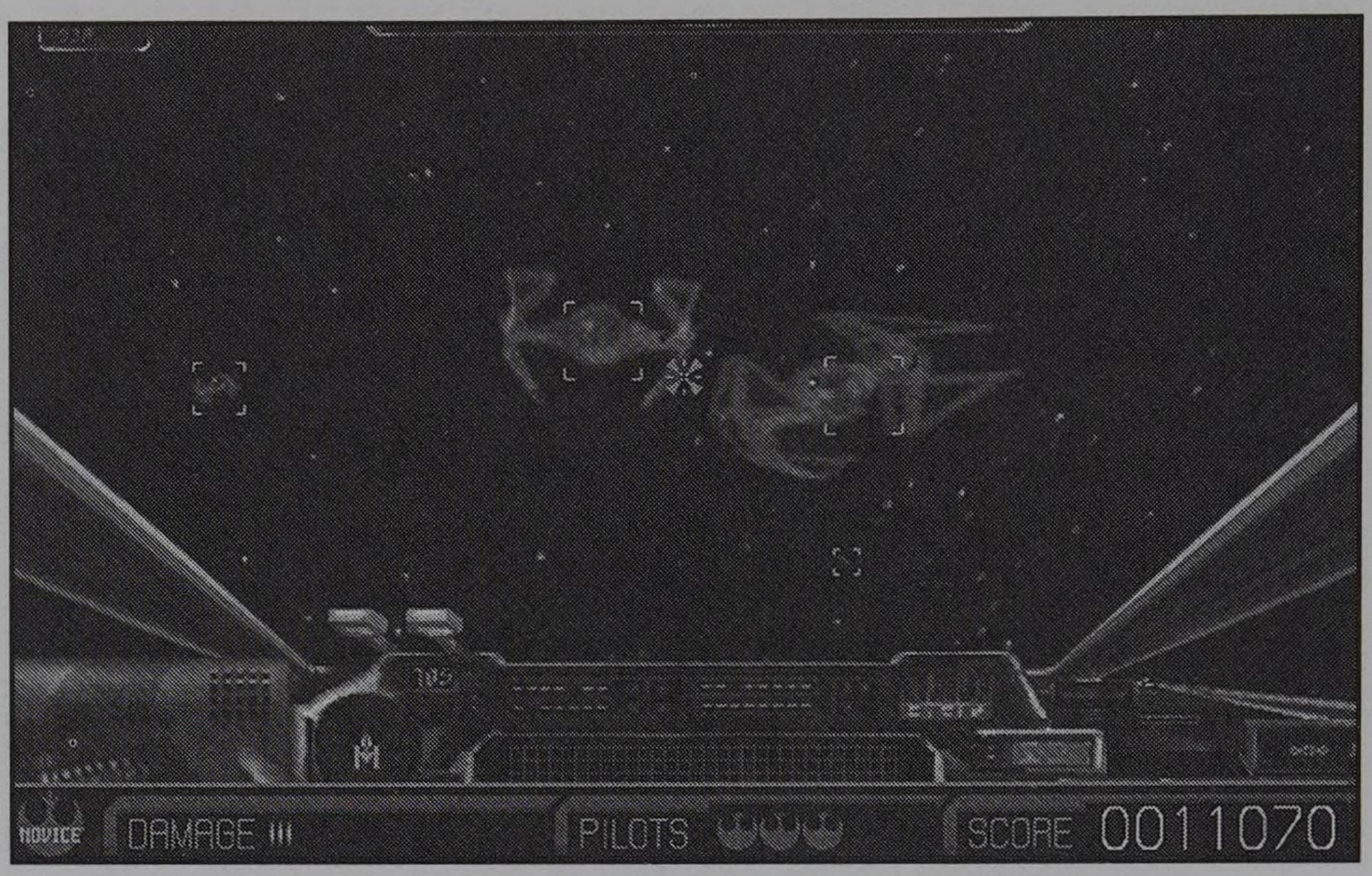
Blast the interceptors from far away before they can lock on to your ship. This is even more important than on other similar levels where it's possible, though not easy, for you to shoot them before they shoot you.

— Chris Snyder



If you can get through this chapter, you've got it made. Pay attention to the voice-over radio chatter to get an idea of how far you are into this level and how much further you need to go. When you hear, "Stay together team. We can take 'em." you're just one or two interceptors away from victory.

— Matthew Azeveda



Don't let any Imperial ships fly by you — that's death, especially in the Standard and Expert levels. This is the hardest of the four "shooting gallery" levels in the game because it's very long and your focus can wander. Stay on one opponent at a time, but if anyone gets close, drop everything and concentrate on that ship alone.

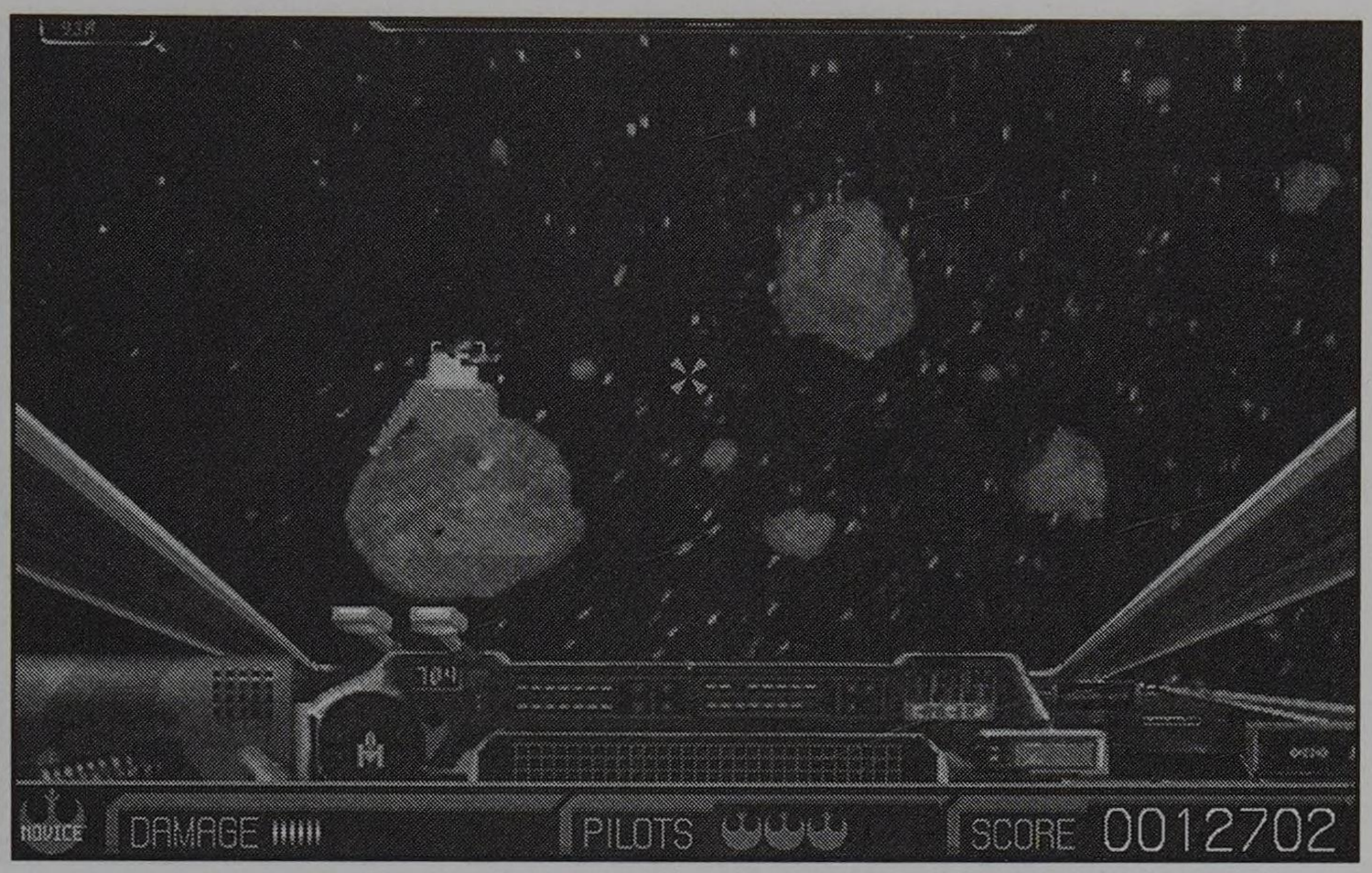
— Albert Chen

CHAPTER 9: THE MINE FIELD

It's a long trip through the asteroids and some of them are armed and dangerous. The goal is to create an opening in the three large, blue, rectangular force fields that are held up by satellites. To do so, you must take out four satellites that are grouped together in diamond fashion.

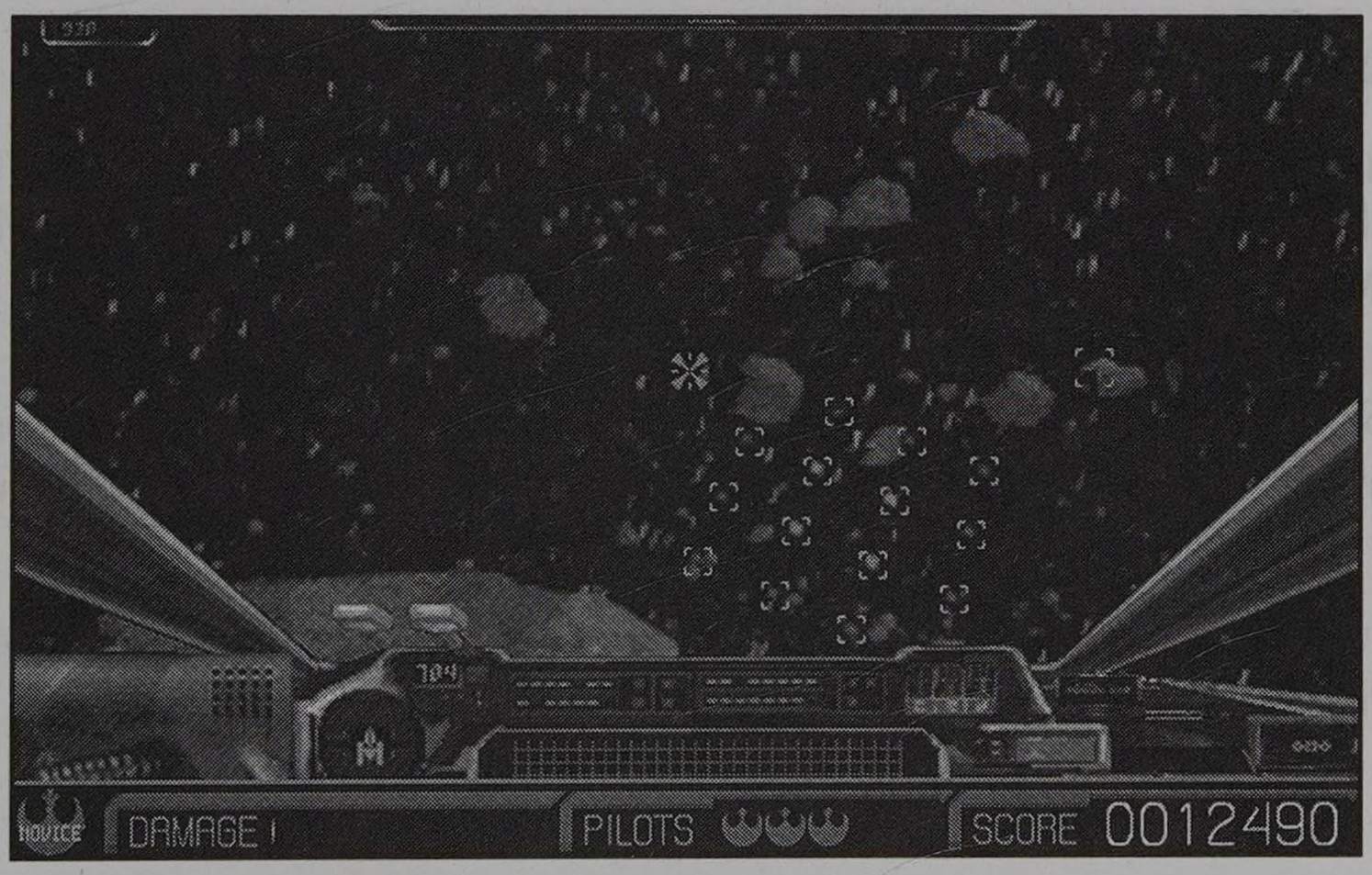
Watch out for asteroids, obviously, but the asteroid turrets are even more dangerous. Hit them as fast as you can; if you let them fly past, they will continue to shoot at you from behind where you can't do anything about it.

— Brad Grantham



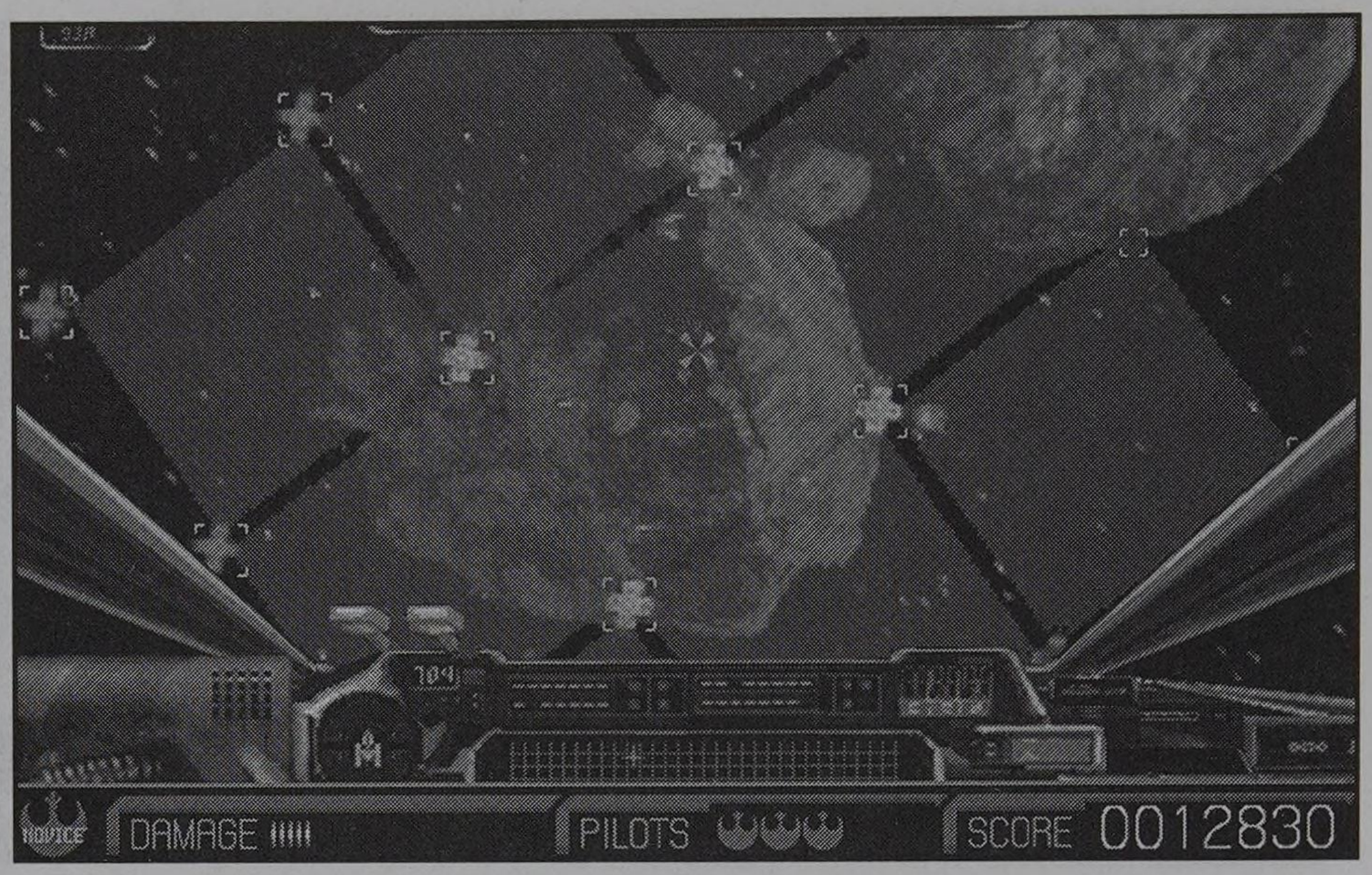
Start by playing this level on the Beginner setting to learn the flight pattern that will keep you away from the spinning asteroids. Once you learn the pattern, you don't have to worry about the asteroids and can concentrate on shooting the asteroid turrets and satellites. You can collect many points on this level.

— James Evans



As soon as you see a force-field grid — way before they are big and blue — shoot at it, aiming for the center. Any satellites you shoot will give you points, but it's only the four satellites around the center section that you must destroy to get through without damage. The force field moves in and out of view, but each time your flight path brings it into view, pop off a couple of shots — it makes it easier later.

— Sean Matheis



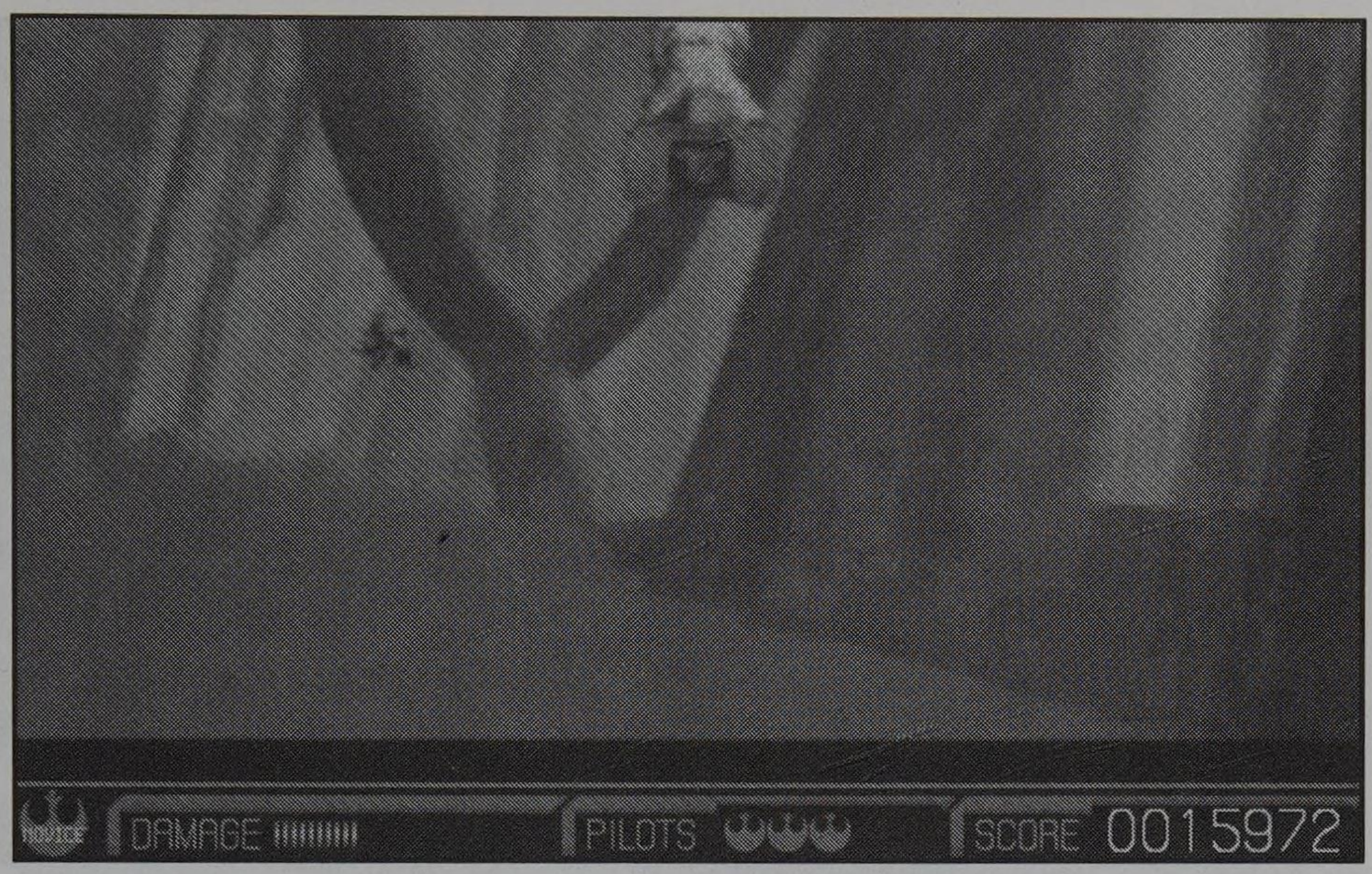
As you get close to the blue grid, fire at the four satellites holding the center section first. After you have those, fire at the others for points. The damage inflicted by not clearing a hole in the field is usually not horrible — except in the Expert level.

— Chris Snyder

CHAPTER 10: SPEEDER BIKES

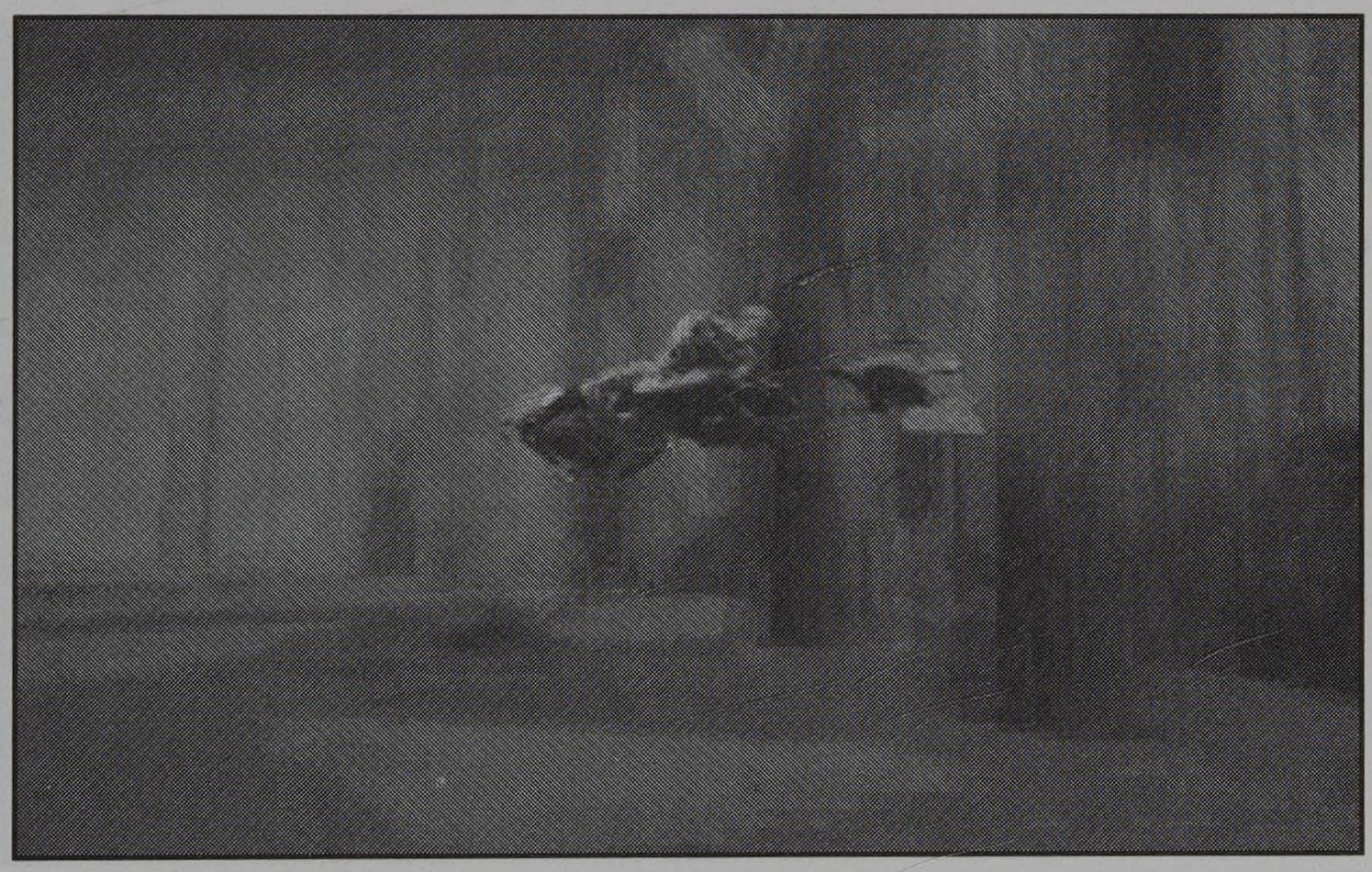
This chapter introduces a brand-new flight machine to the *Rebel Assault* hangar — the speeder bike. Chapter 10 is one long stage, and you take the third-person view following behind Ru Murleen's bike. You must avoid the trees and landscape obstacles, of course, but much more important is killing mynocks. What are mynocks? You may remember them from *The Empire Strikes Back*. They're the bird-like creatures that cling to the *Millennium Falcon*. Here they're after Ru Murleen, and in a unique twist, every time they strike her, she screams and you take on the damage.

This level is much easier with the joystick than the mouse. It takes very, very subtle movements with the mouse if you want to avoid hitting the trees.



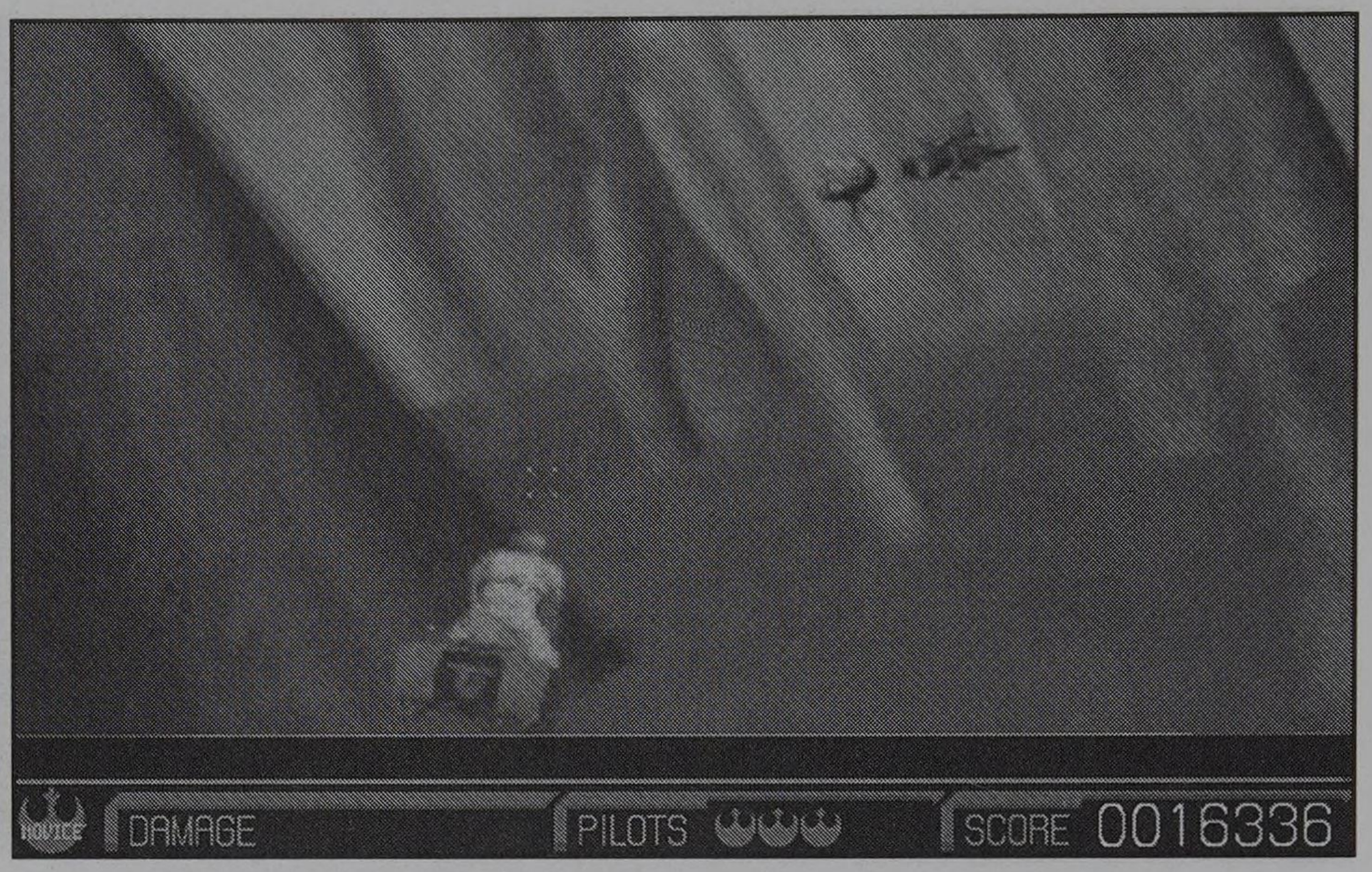
The flight path is not as demanding as in some levels. In fact, if you hold your joystick so that you're flying either low or high — preferably high — you won't hit much of anything. Then you can just stay centered and dodge right and left to avoid obstacles. Even if you do hit trees or the ground, the damage is not severe. This lets you concentrate on the mynocks.

— Albert Chen



If you're experiencing trouble on this level, play on the Beginner setting until you learn the flight path. But this is not nearly as critical as in the asteroid levels. If your damage is soaring out of control, lower the Shot Damage in the Difficulty Editor. That reduces the accuracy of the mynocks, thus the shots that damage Ru won't damage you as much.

— Brad Grantham



The key to this level is killing mynocks. The gasbags that you occasionally confront won't hurt you, and they are strictly for points and the joy of seeing them explode. The damage is set high for missing a mynock. Miss just one or two and you're a goner. Even if you don't miss them, but they get Ru, the damage is nasty.

— Brian Kemp

It's not too hard to hit the mynocks. As soon as one flies into your vision, start shooting. Usually they move right into your shots. The best tactic is to aim directly at Ru. You can't kill her, but because the mynocks take position right behind her, they will fly into your barrage. You should concentrate on shooting more than anything else on this level.

— Chris Snyder

CHAPTER 11: INSIDE THE TERROR

After so much flying about, it's nice to be back on the ground shooting packs of stormtroopers. This chapter has three stages and is similar to Chapter 2. The same battle rules apply.

Stage 1

Here you're firing up at three stormtroopers on a catwalk. In a battle with three troopers, if you see them all charge out at once, it's always best to take cover. It gives you some time to enjoy the Imperial architecture. But don't think you can just sit there and heal yourself — you can't.

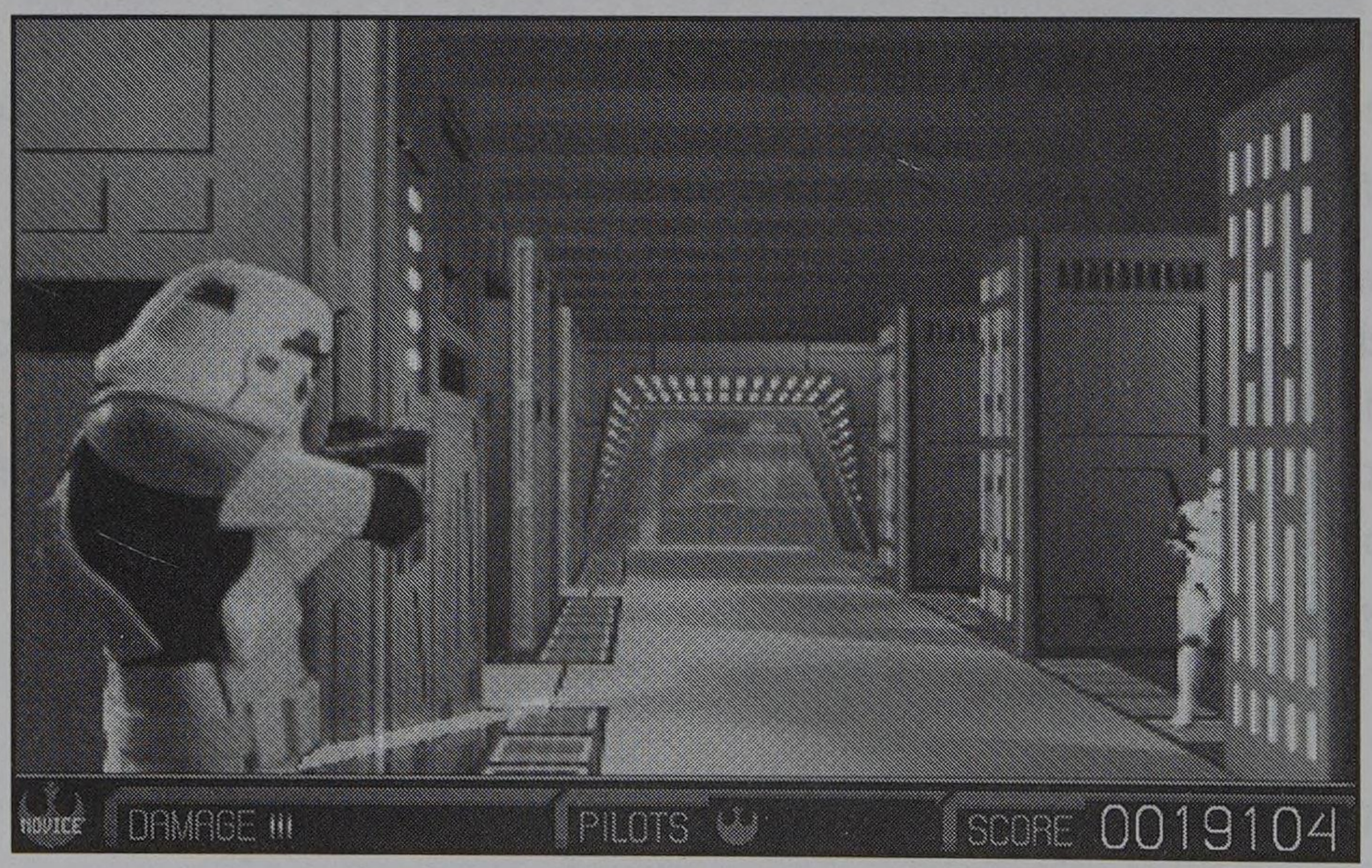
— Matthew Azeveda

Position your targeting cross-hairs over one of the areas where a trooper will appear. It's best to choose the area where you blasted the first trooper. By the time you've blasted the others, the first one will be up next. If it's a three-trooped stage like this one, you'll have at least a 33.3 percent chance of picking the troopers off before they can blast you (and a 50 percent chance on two-troopered levels).

— Matthew Azeveda

If you see more than one trooper out there, duck. You can only target one trooper at a time, so why expose yourself to damage unnecessarily? If you're firing at one, the other will fire at you. Work on your aim here and learn the pattern of their appearance. With only three points to target, all of which are relatively close, teach yourself to go to each point quickly and fire. Also, keep firing at one target until you get the kill. If you hit a trooper the first time it appears, you get more points.

— Albert Chen

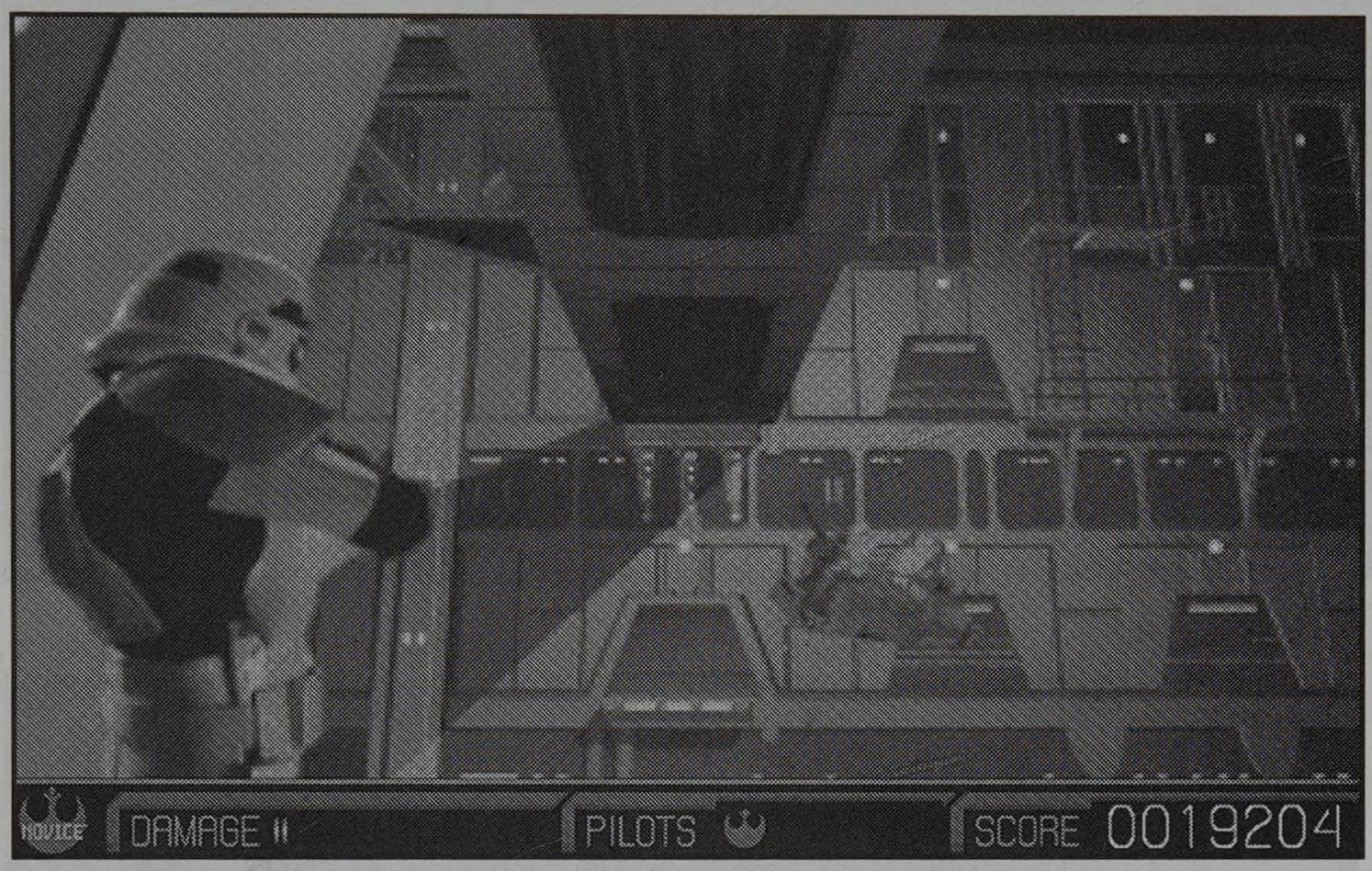


Stage 2:

Three more stormtroopers come at you from three walls in this battle. Fortunately, all three are on your right, and they usually appear one at a time. Hit one and the next appears — very hospitable of them. Because they don't gang up on you, you can pretty much stay out in the open.

You don't need to avoid every shot in this battle. More advanced players, however, can shoot and duck back behind the wall, avoiding all damage. Besides, it looks cool.

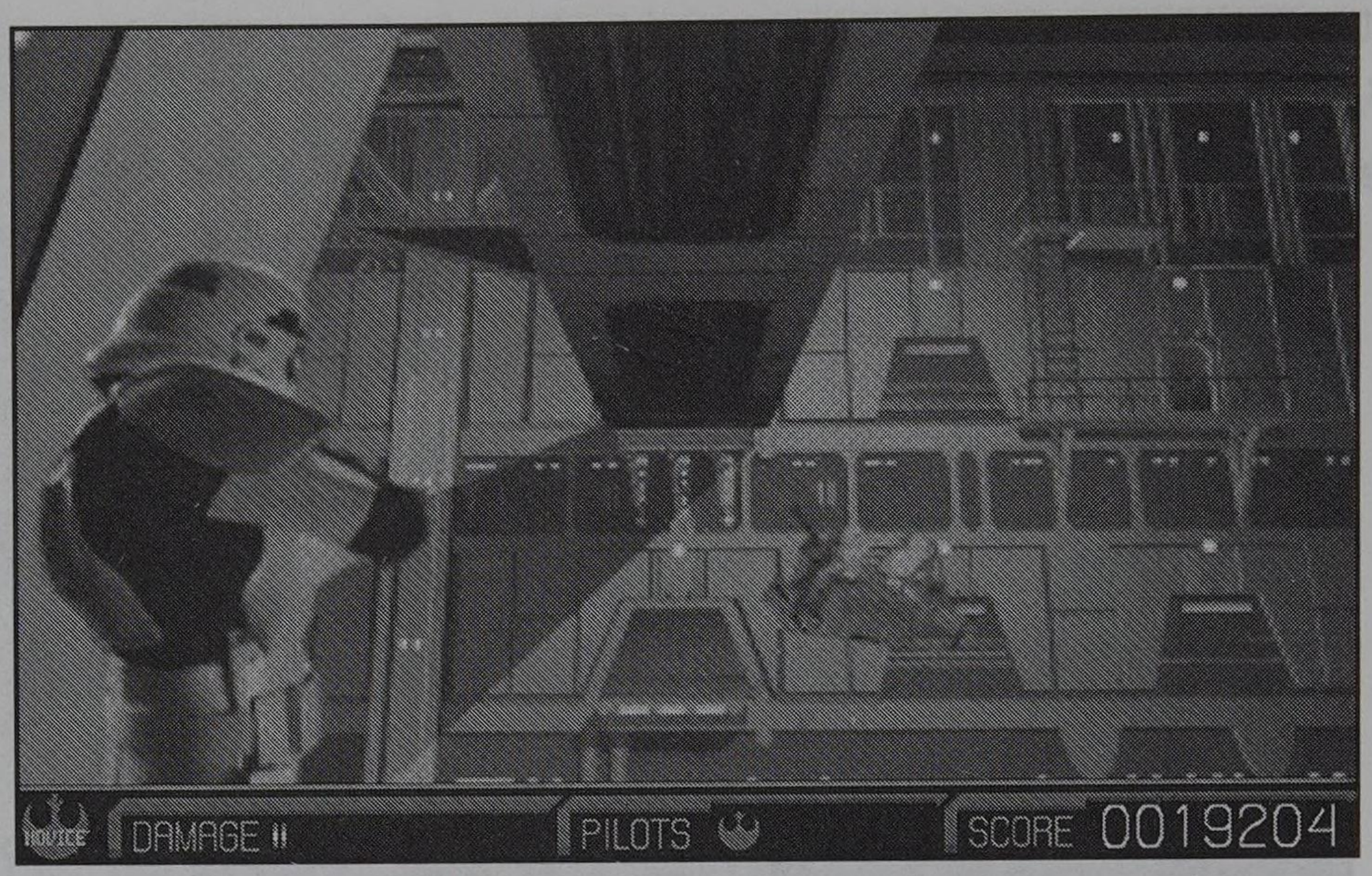
— *Sean Matheis*

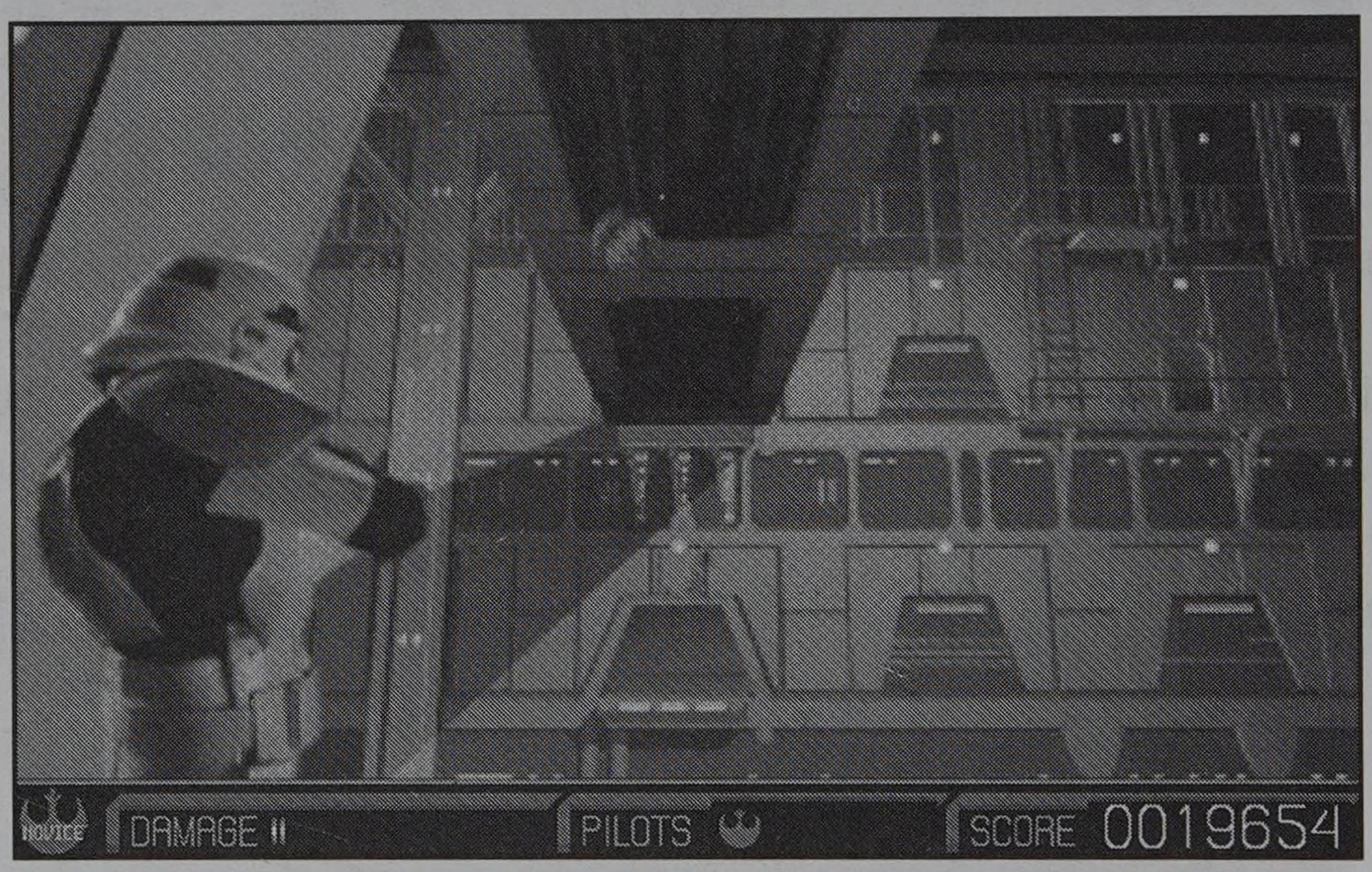


Stage 3

This battle's goal is to shoot the three struts that support the catwalk above you. If you don't get them, the stage will go on almost indefinitely. With troopers popping out of only two doors, you have plenty of time to focus on the struts.

— *James Evans*



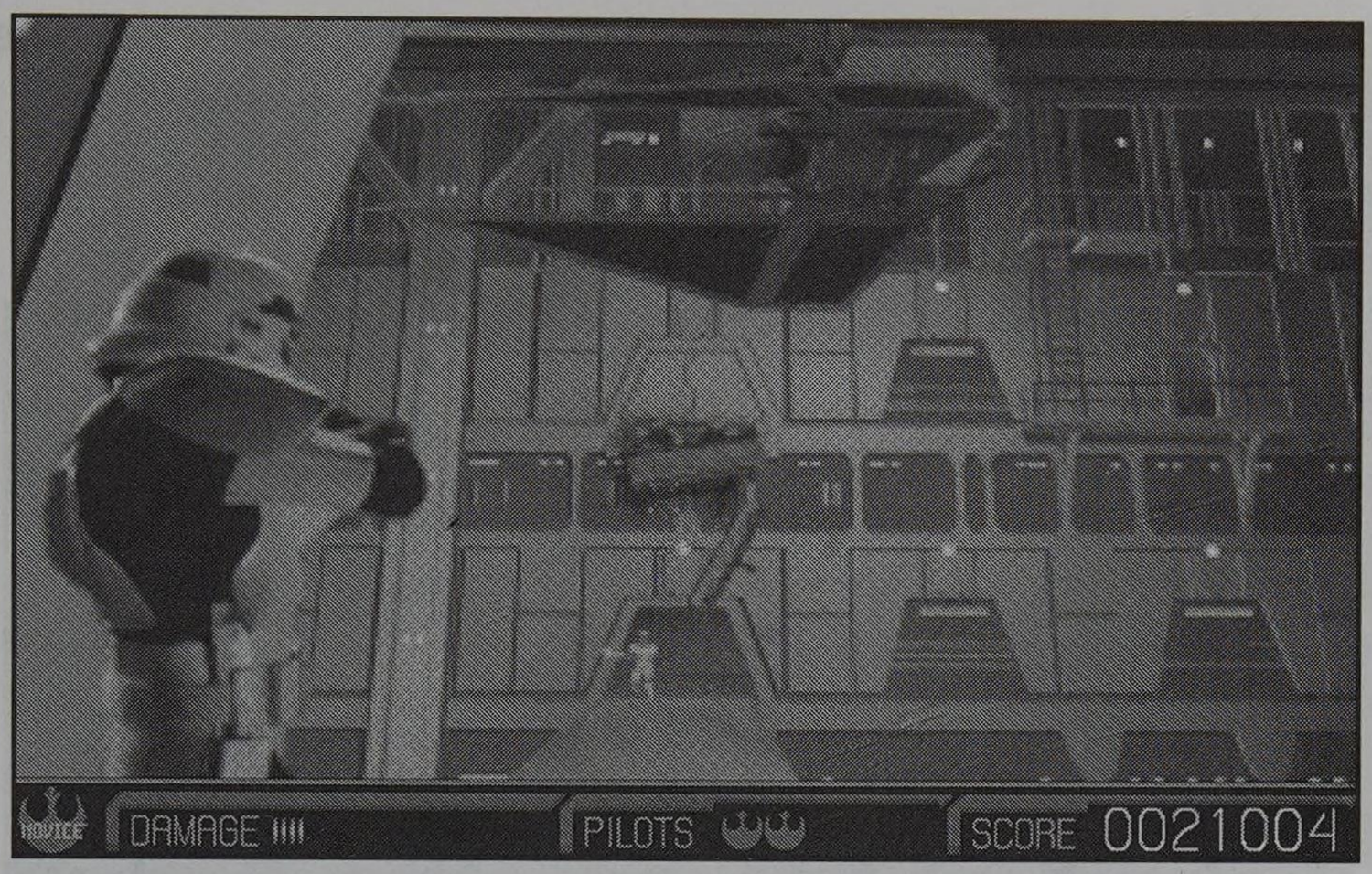


Unfortunately, you can't take out the hoversleds and drop them to the depths below in a flaming mass of twisted Imperial debris, but you can shoot the grenades (Imperial meatballs) that they arc at you in sets of three.

— Matthew Azeveda

These sleds don't come immediately. If you've shot all the troopers, Ru will shout at you to do something — that means the sleds and their grenades are coming to prod you into action. These grenades, which inflict major damage, come in an evenly spaced pattern. The best time to shoot them is at the arc of the lob — that's when they're the biggest.

— Sean Matheis



After the bridge support falls and crushes the trooper, more troopers will come, but not as many. Stay behind cover and methodically shoot them as they appear.

— Sean Matheis

CHAPTER 12: SEWERS

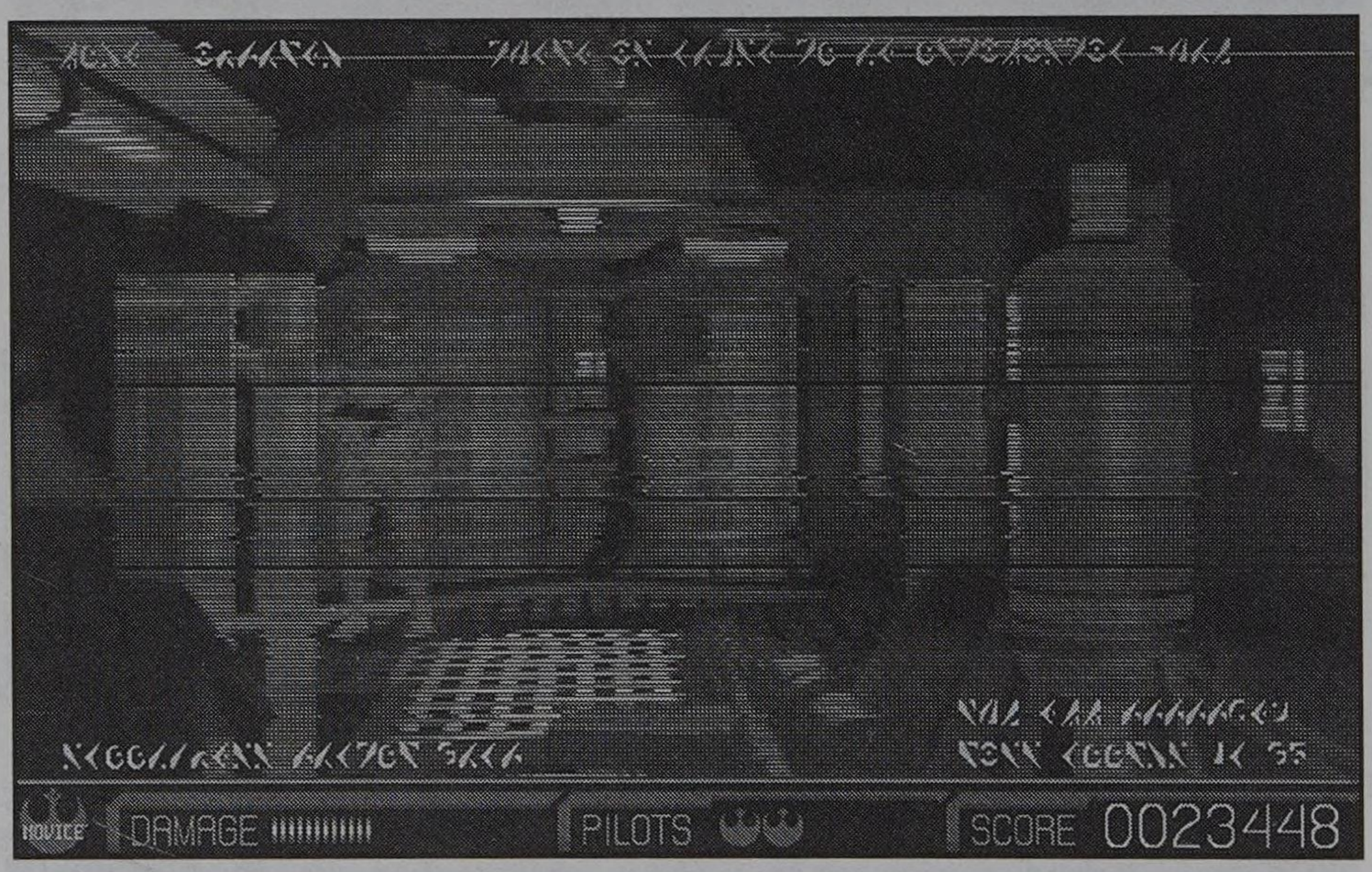
How about a four-stage chapter? This one looks like a tribute to *Dark Forces* with its green and red night-vision colors and swarms of stormtroopers.

Stage 1

Troopers appear from behind two tanks here. The pattern is that the guy on the right will shoot from cover, but the guy on the left will take steps out into the open. So take out the guy on the

left quickly — then concentrate on the right trooper. Since you have no cover here, the key is to kill the trooper quickly — i.e., take one shot and then get ready for the next one.

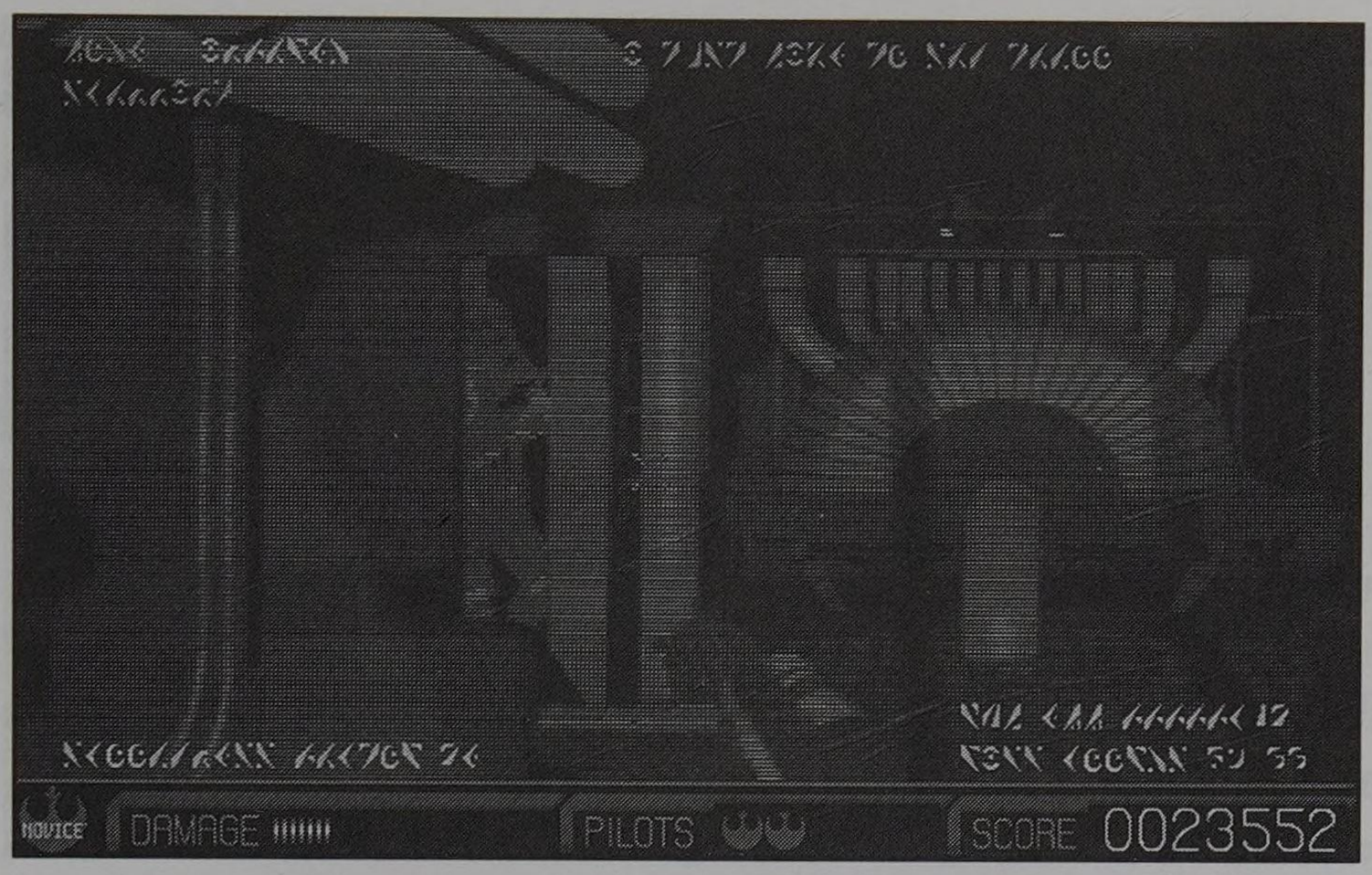
— Sean Matheis

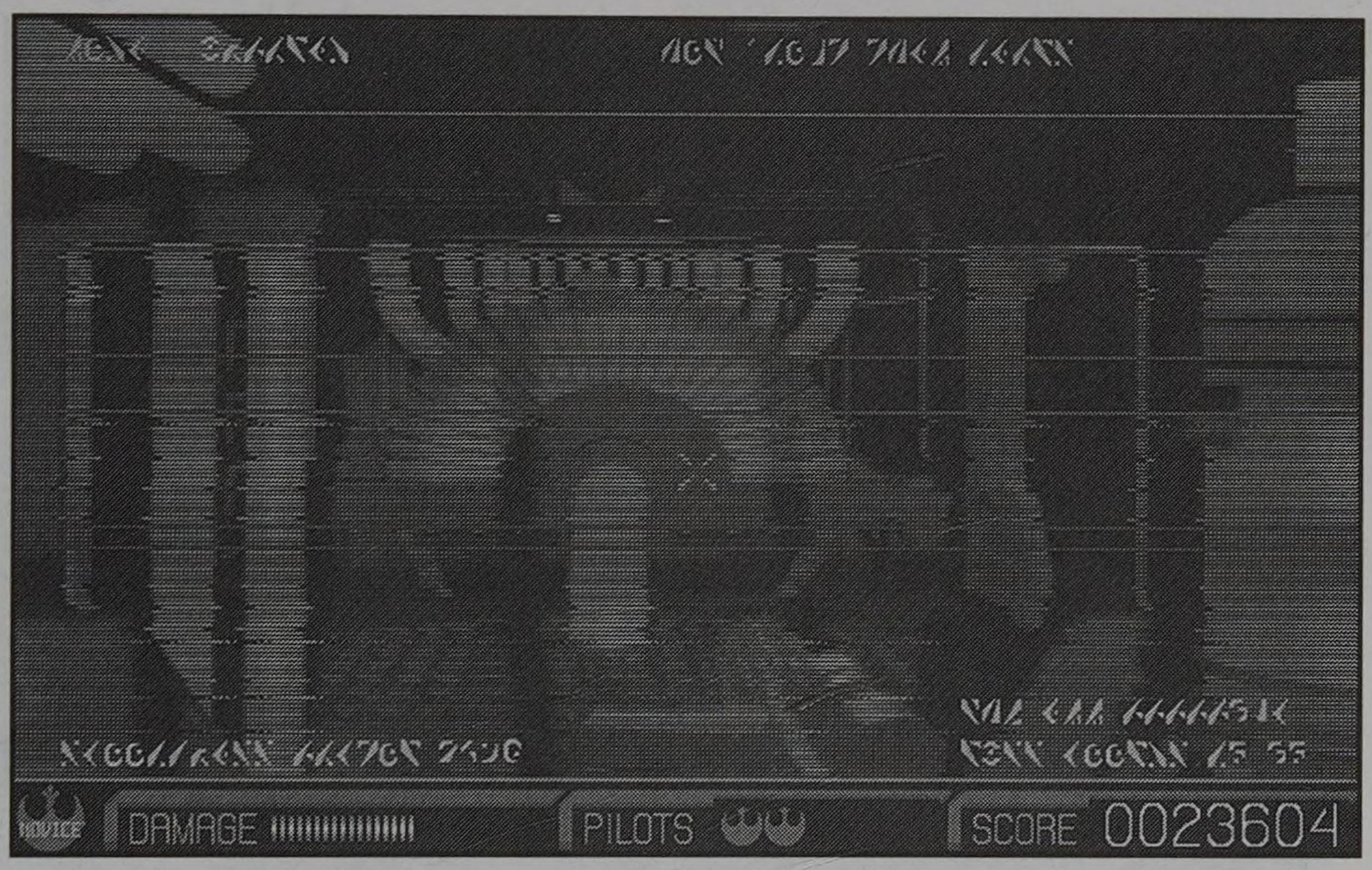


Stage 2

It's the same kind of battle, but this time the trooper on the left drops down from the ceiling and stays out in plain sight. The trooper on the right keeps under cover. Shoot to the left first, then to the right. Because you can't take cover, shoot as fast as you can. The wrinkle here is that droids will come into play — take them out quickly because they will shoot and cause damage. The good news is that you never have the droids and the troopers shooting you at the same time. But concentrate on the droids first because they shoot faster.

— Albert Chen





Stage 3

Things toughen up here because both troopers fire from cover. The trooper on the left, between the pillars, is most difficult to hit. Droids come from the right side. Shoot them first. While you're firing at one, a second guy might get a few shots in, but it's not deadly.

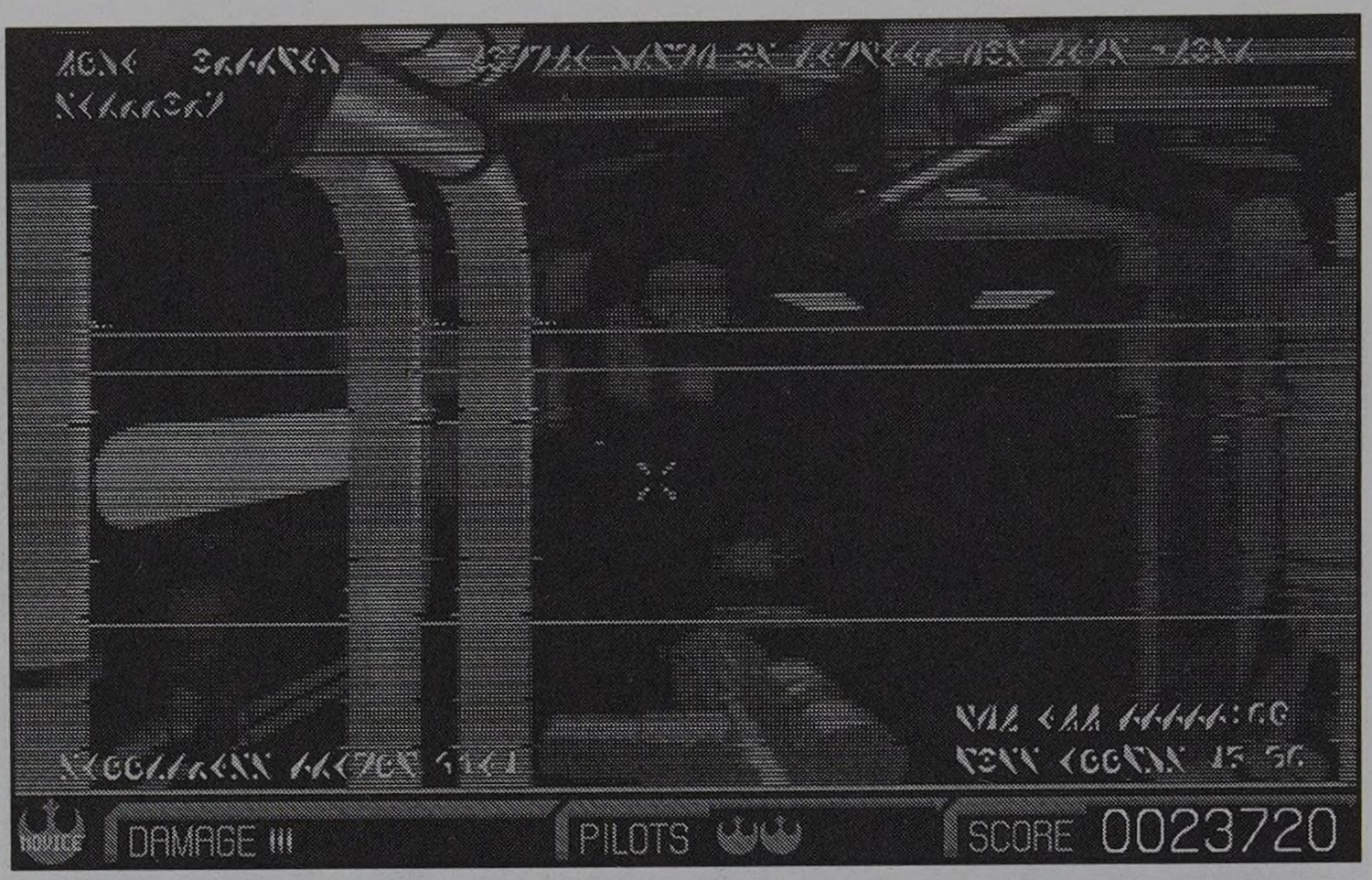
— Chris Snyder

Never aim in the center of the screen. Instead, aim to one side or the other so you can pick off one guy, then the other. It's best to favor the right side because one trooper and the droids come from that side and you can keep a better eye on them.

— Chris Snyder

Think fire suppression in this level. That means shoot everything possible and try to suppress the enemy targets before they have time to get into position, move, react, and retaliate.

— Chris Snyder



Stage 4

This is the toughest of the four stages, so stay on your toes. There's definitely a pattern to the targets. First, the trooper from elevator will appear. Then the trooper on the left side appears. Then the trooper on the far right. There's not much variation in this pattern, except the trooper on the right may appear twice in a row to keep you honest. The guy on the right is the hardest to shoot because he takes cover well.

— Brian Kemp

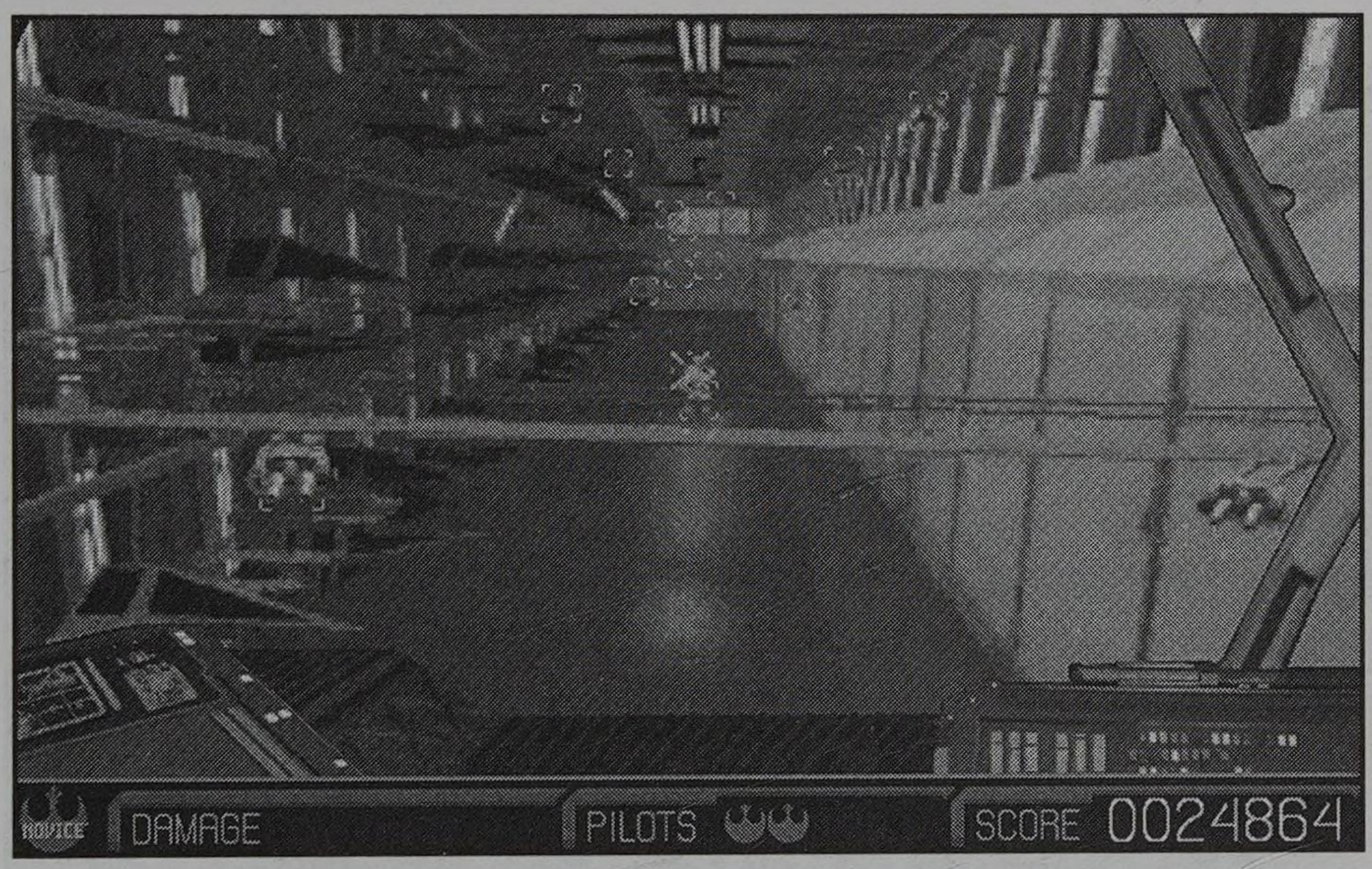
Watch for the droids that come from the center of your screen. They dodge a lot, and they're really hard to shoot. Fortunately, they appear by themselves, which gives you a break

from the troopers. If you miss, keep shooting until you get it. You might take a few hits, but it's best to vanquish each target before moving to the next.

— Brian Kemp

CHAPTER 13: ESCAPING THE STAR DESTROYER

You've just made Darth Vader look like a fool. Starting with this chapter, the game is coming to an end and, as Brad Grantham said, "The last chapters become more intense than similar ones you found earlier in the game — which is what you expect a game to do." This chapter is not just a shoot-em-up, but a dodge-em and a shoot-em-up, which makes it even more challenging than most. It requires that you fly a stolen cloaking TIE fighter through the superstructure of the Command Ship *Terror*, and find an escape hatch. The chapter features three distinct stages.



Stage 1

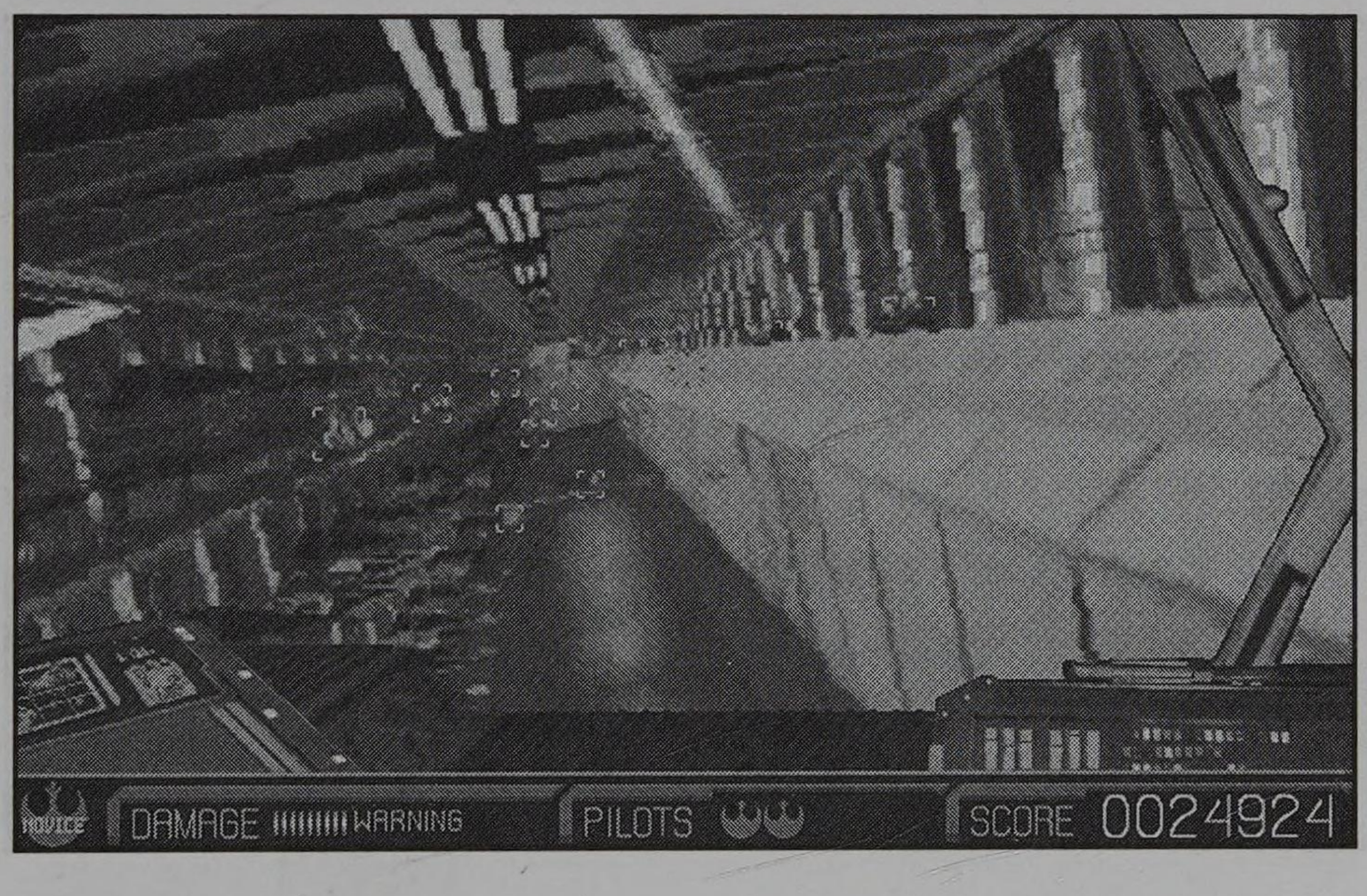
The key to this chapter is to avoid taking much damage in the first stage. Shoot anything and everything that is shooting back at you. This includes gun turrets and stormtroopers (troopers vaporize quite nicely when shot). You'll also need to avoid colliding with any other craft maneuvering in the hangar bay.

— Sean Matheis

Dying to know the pattern out of this hangar slalom course? Here's it is, and it can be tricky. First, turn left at the start to avoid some TIEs that roll out at you from their docking positions...

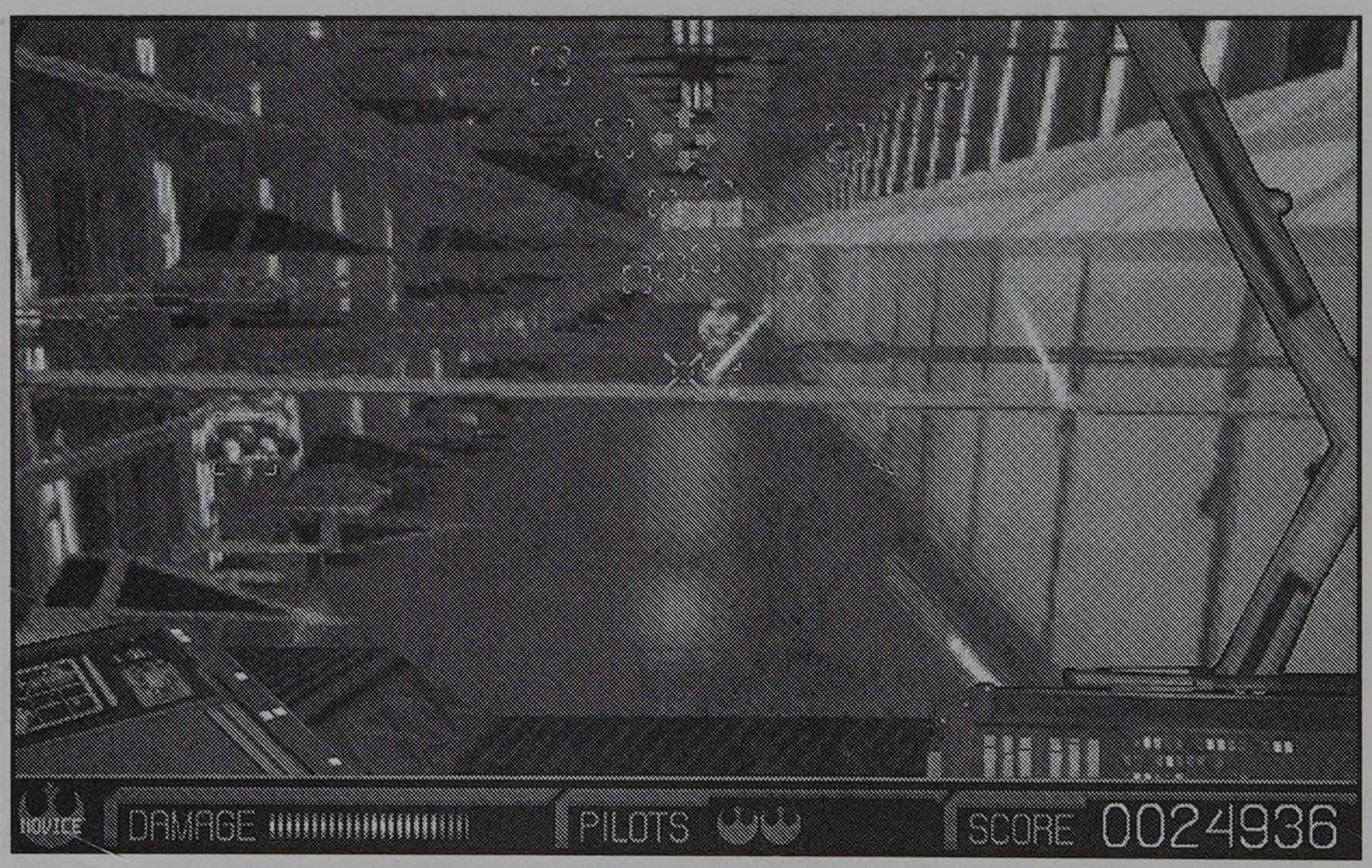
...then turn right to avoid more rolling TIEs.

When two more TIEs cross your path, you need a quick movement: first left, then right.



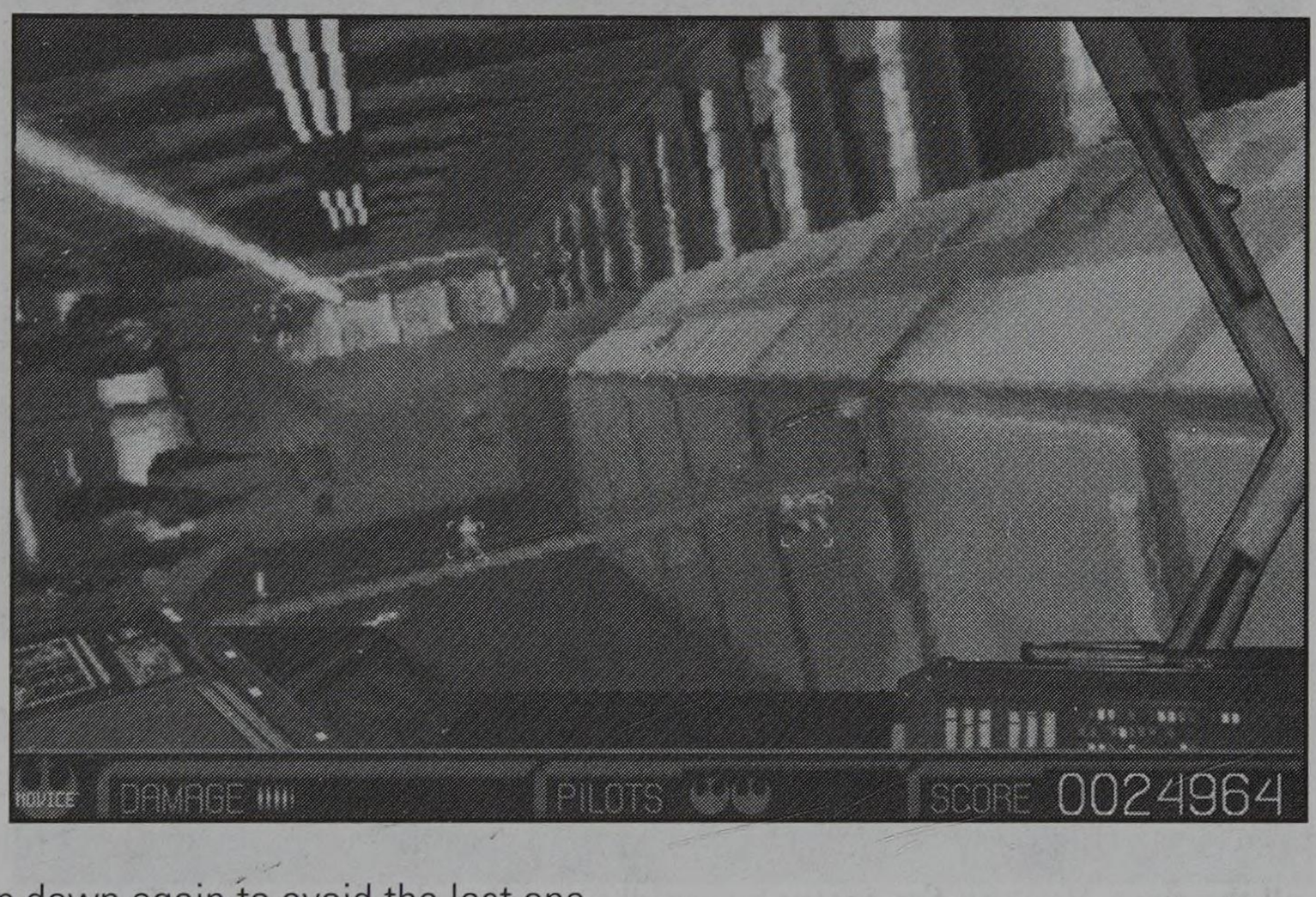
A few turrets will shoot at you, as well as some troopers on the catwalks. Just learn the flight pattern so that you will have time to focus and shoot them with accuracy.

After you take a big right turn, take out all these gun placements...



...and when you see the first catwalk, dive low to duck under the walk or you get dented.

Pull up to avoid the second catwalk...

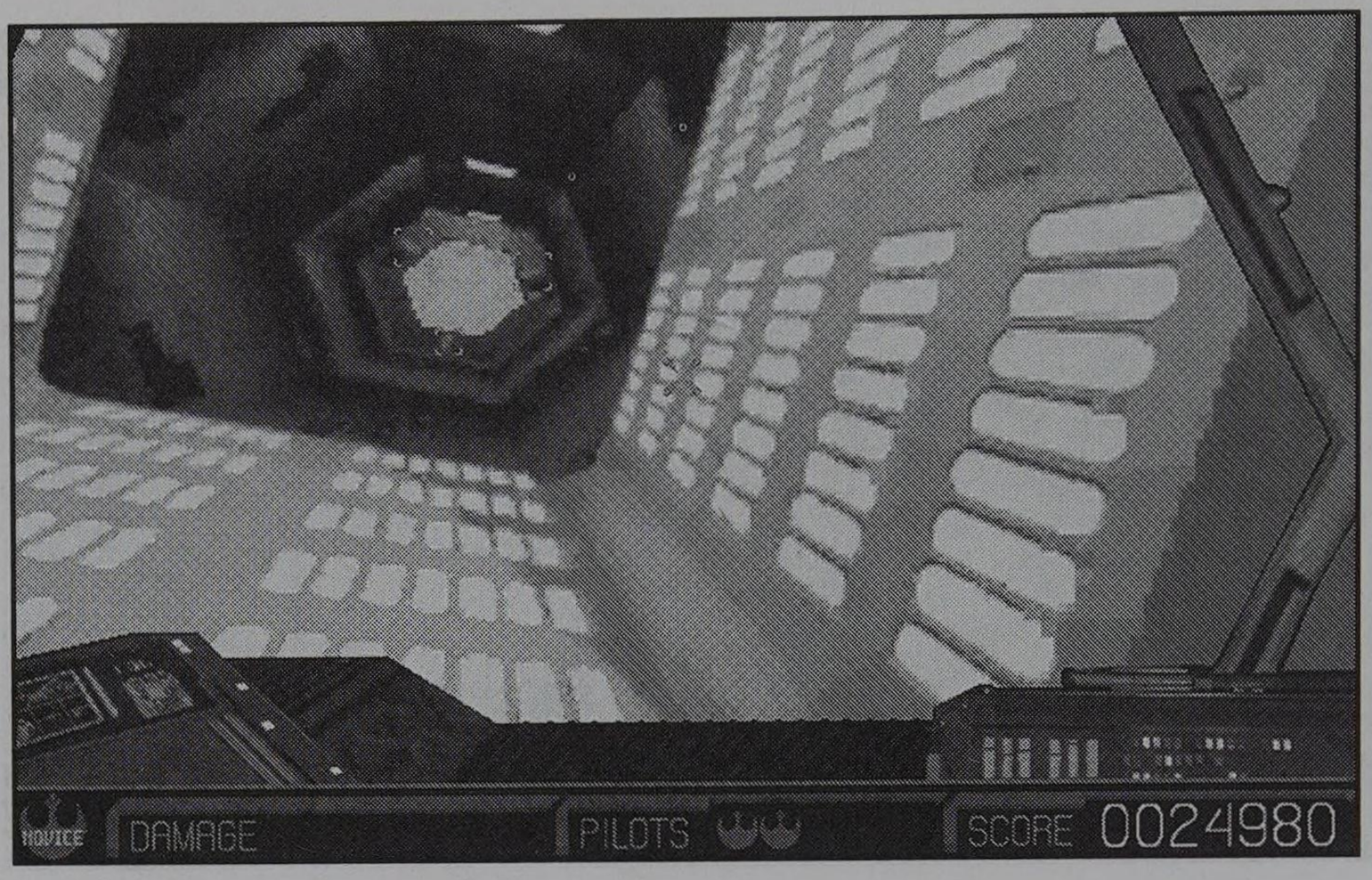


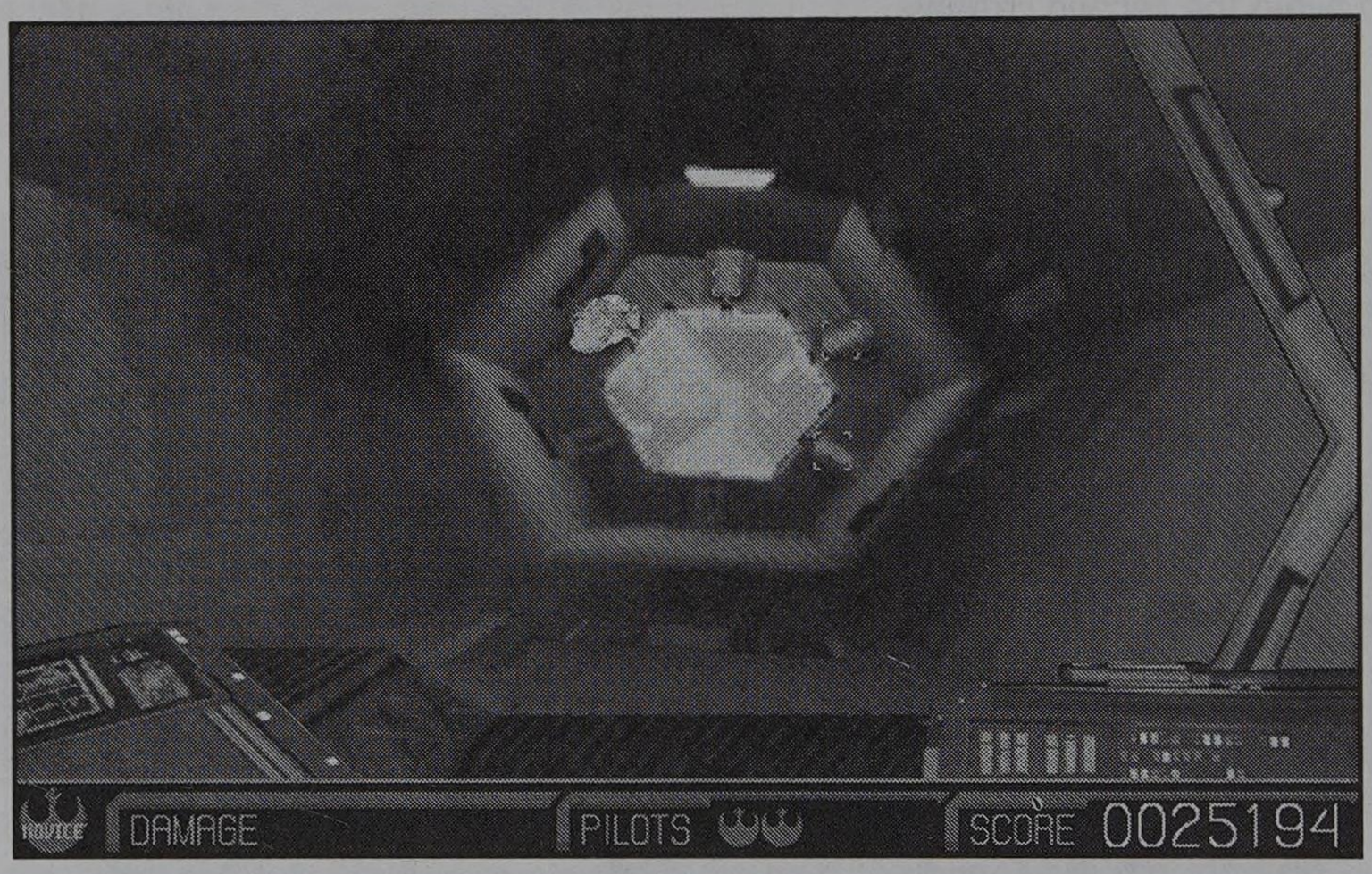
...and dip down again to avoid the last one.

— Sean Matheis

Stage 2

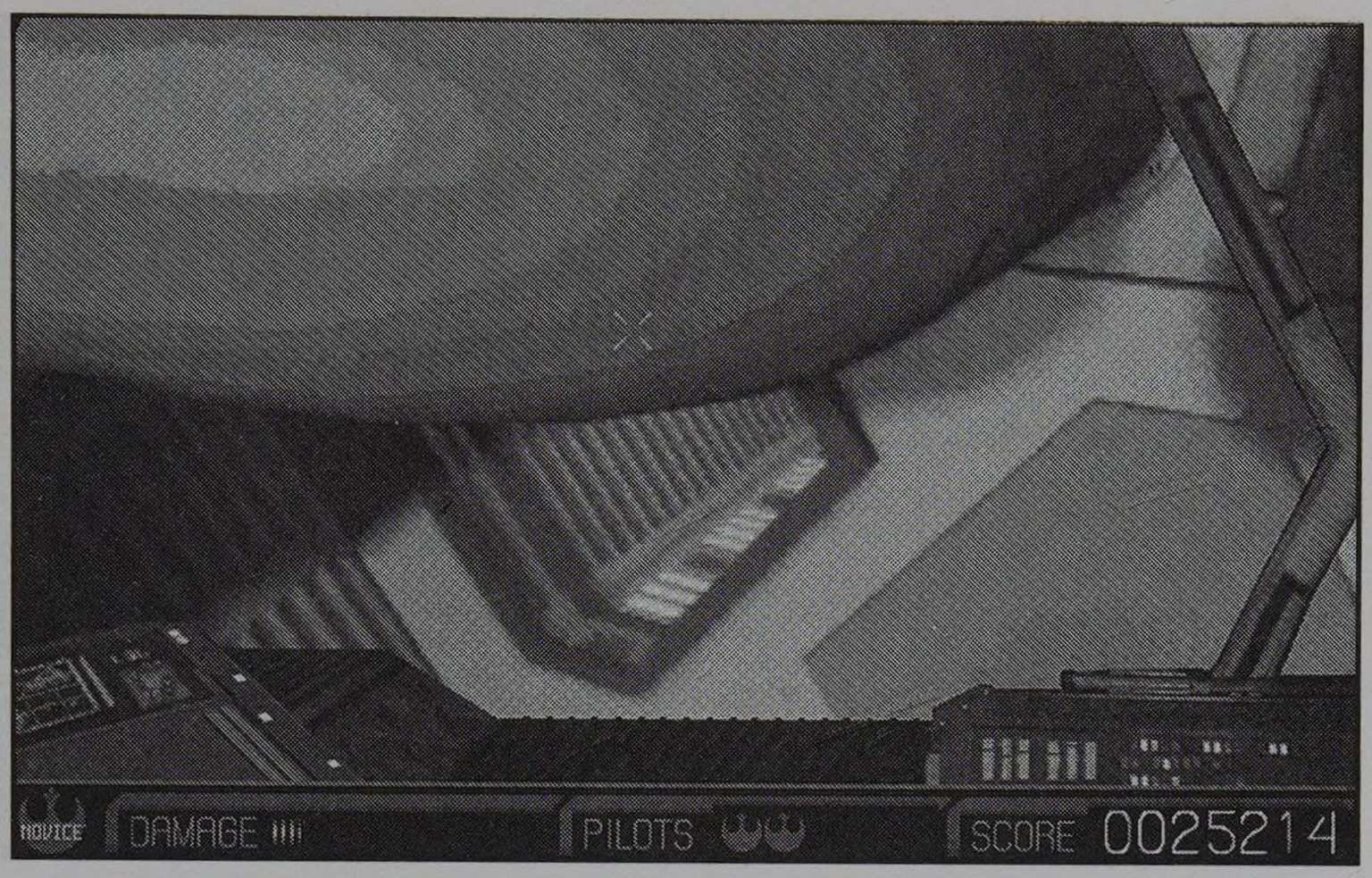
Once you're past the first stage, you'll shoot out a few shield generators and have to work your way through a maze-like part of the structure featuring moving platforms that block you as you approach. The idea here is to react and get out of the way as quickly as you can.





As you fly into the hexagonal tunnel, you're about to confront three sets of force field generators. You have to shoot all three shields on the first and all six shields on both the second and third. The key is to shoot early and fast. As soon as you spot them, fire away. Don't rely on Auto-fire all the time. You can fire faster by rapidly pressing the Fire button. This helps a lot, on all levels.

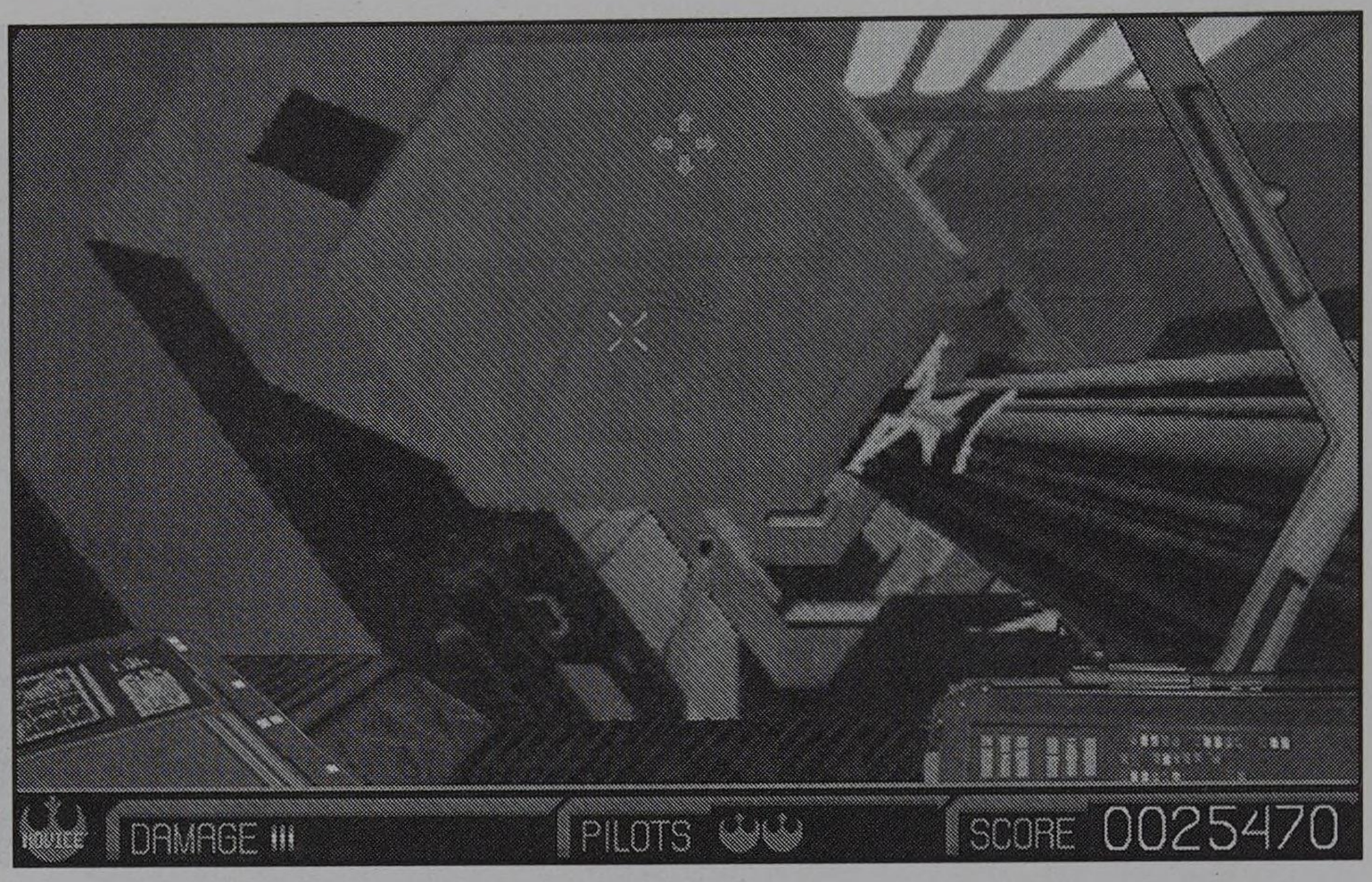
— Matthew Azeveda

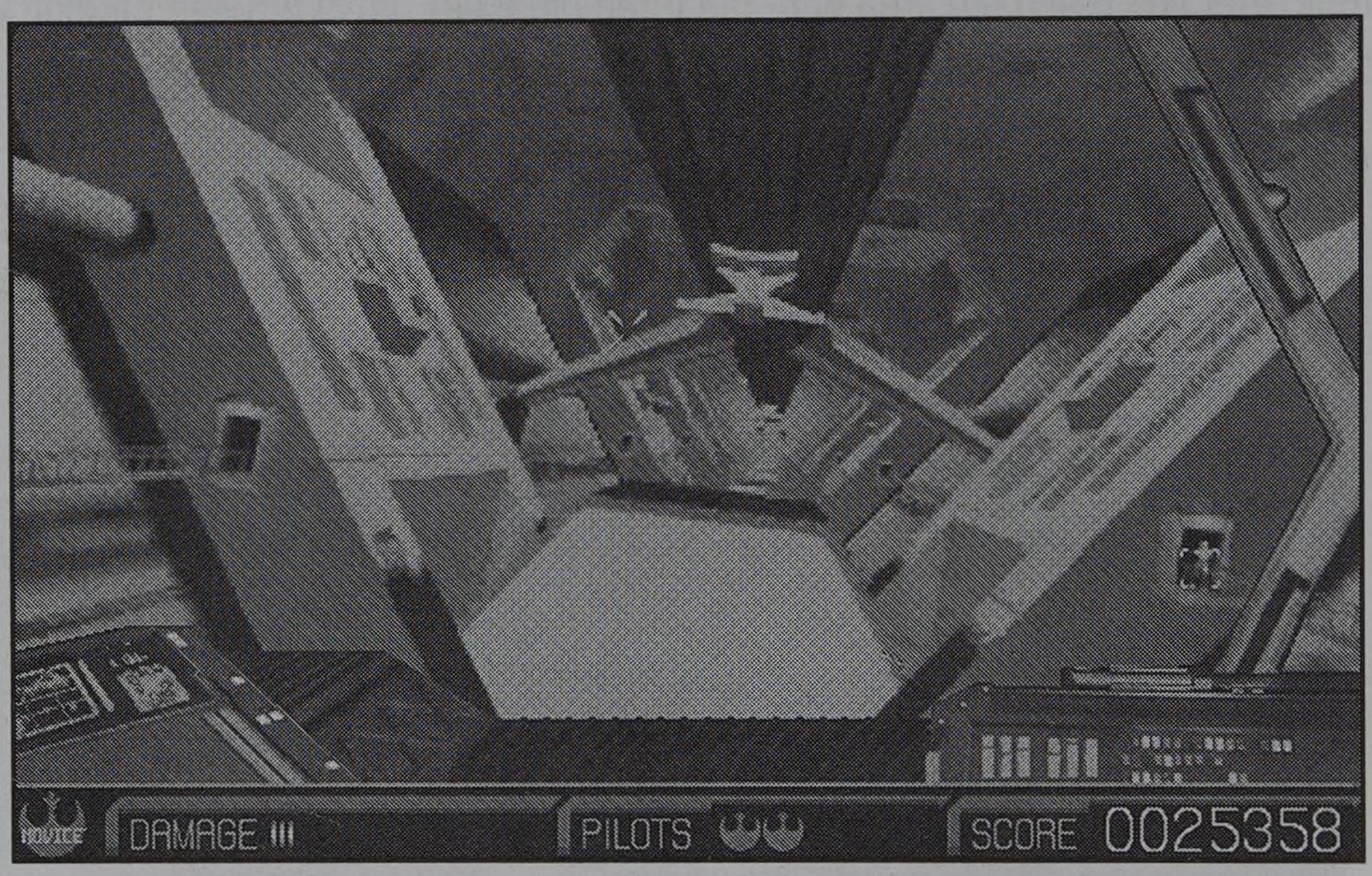


Immediately after you reach the area with the three big pipes, push forward hard on your joystick to dive sharply to avoid this obstacle.

— Albert Chen

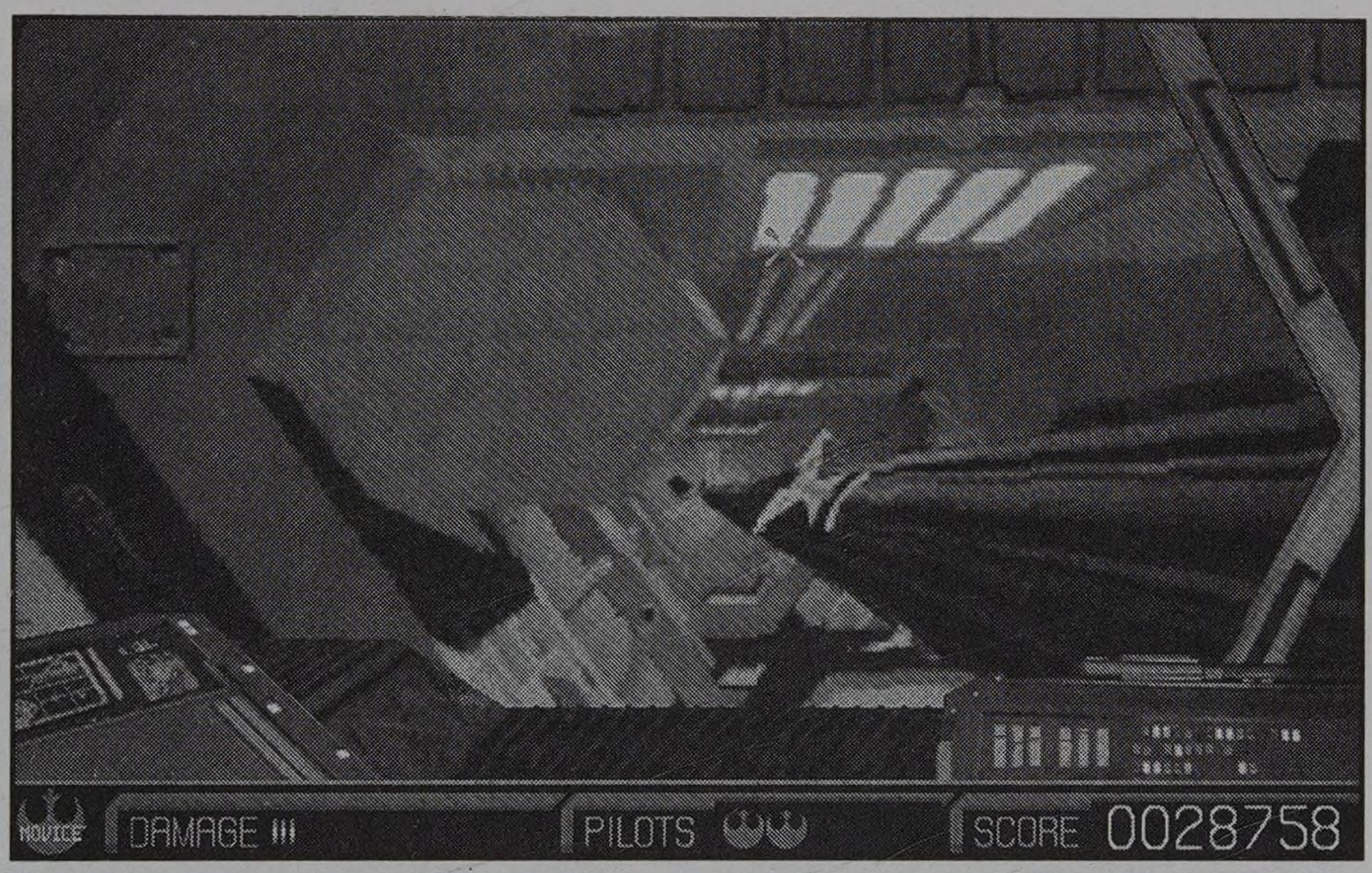
Now you're in the tunnel with the moving plates that squeeze you into quick turns and openings. Learn the pattern and don't worry about the three small gun placements in this tunnel — they can't hurt you very much. Concentrate on dodging and learning this pattern...





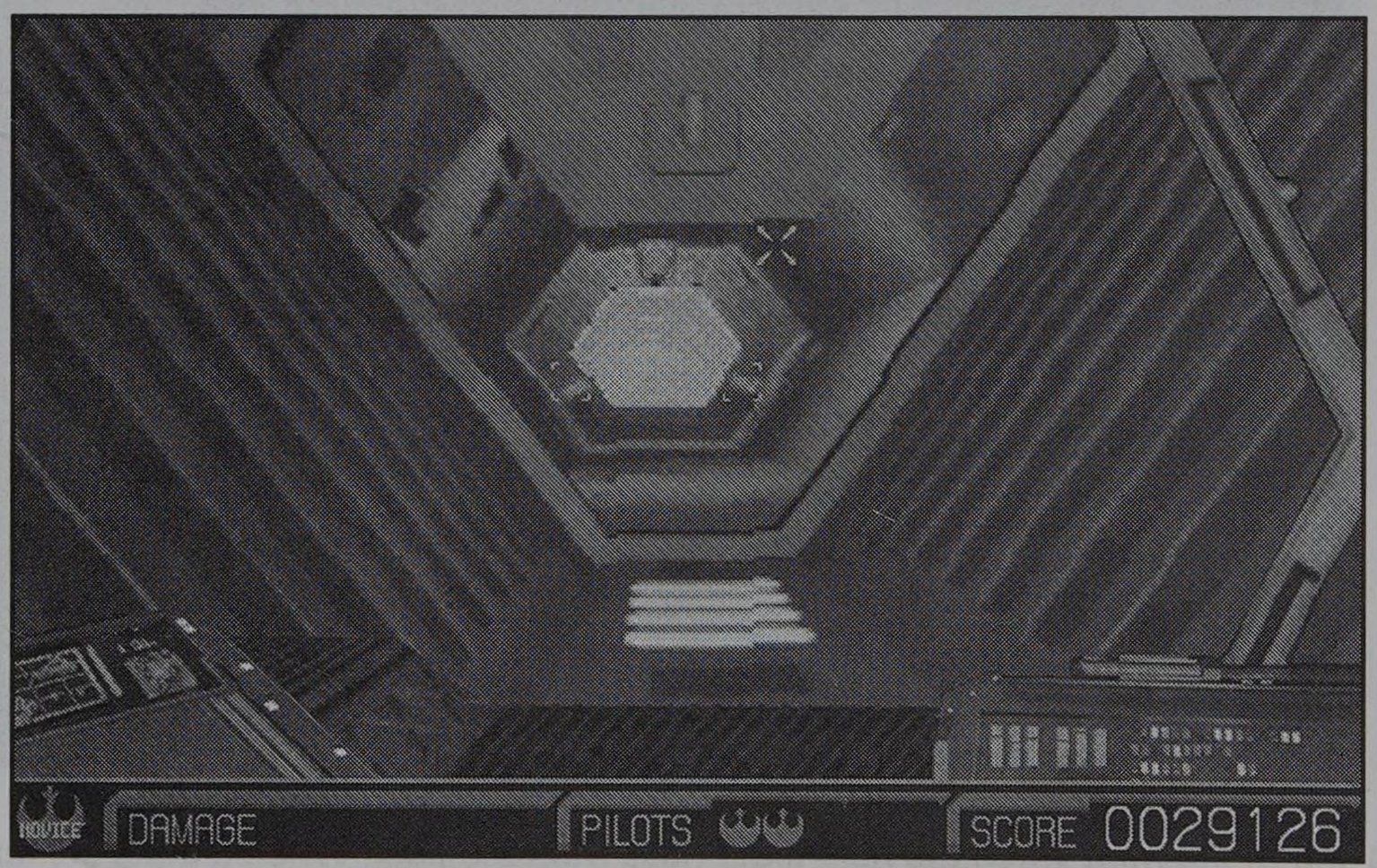
...first, go up, and when the second plate comes up, go up again, then immediately go down.

Then fly down through this next small opening on the left when two plates come out. Blast another turret...



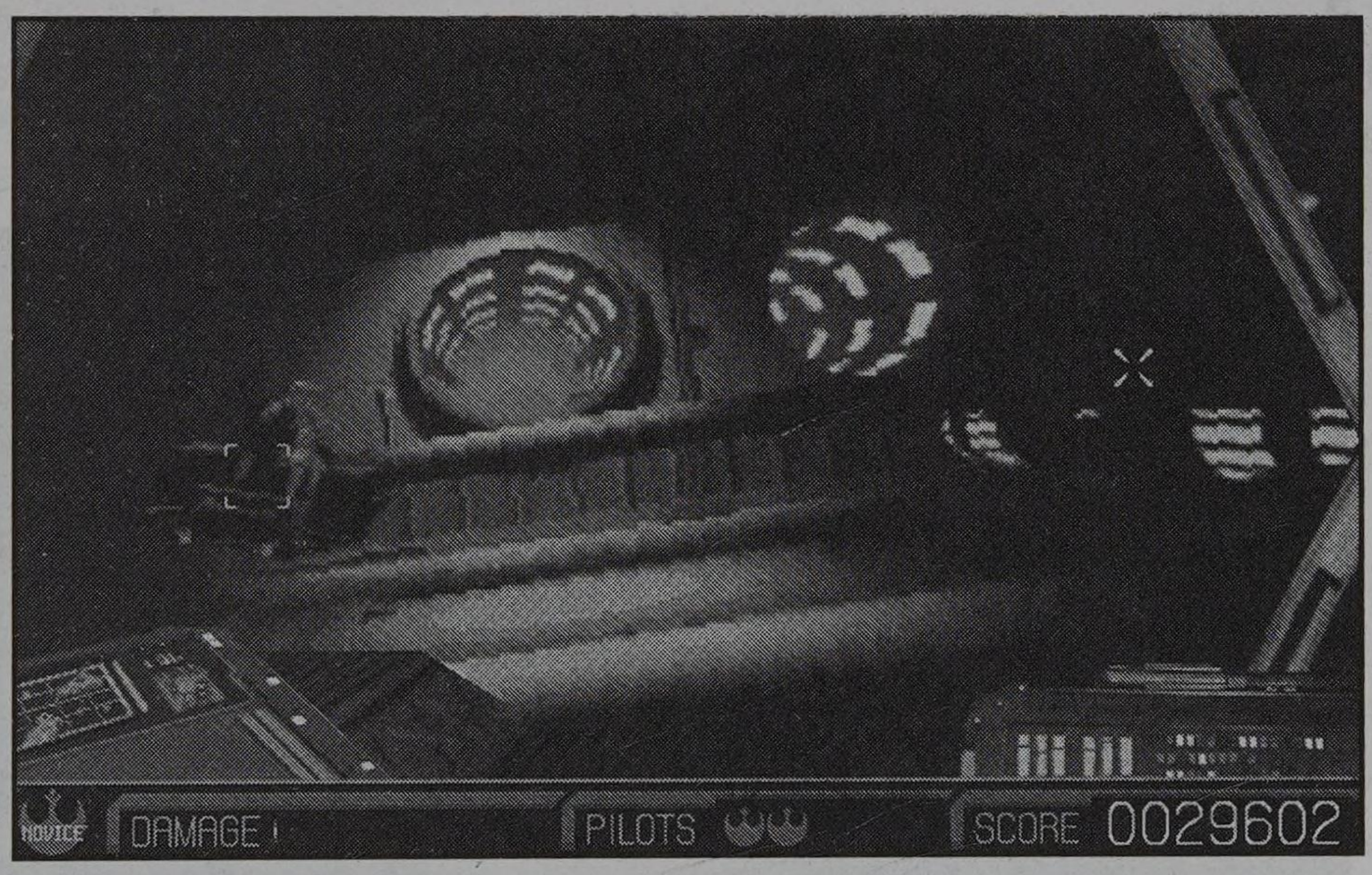
...go up and to the right when the next plate rises from the floor. When a plate comes from the right wall, duck down...

...another plate comes up, and you go up with it. Still another plate comes up, and you go up and stay up there.

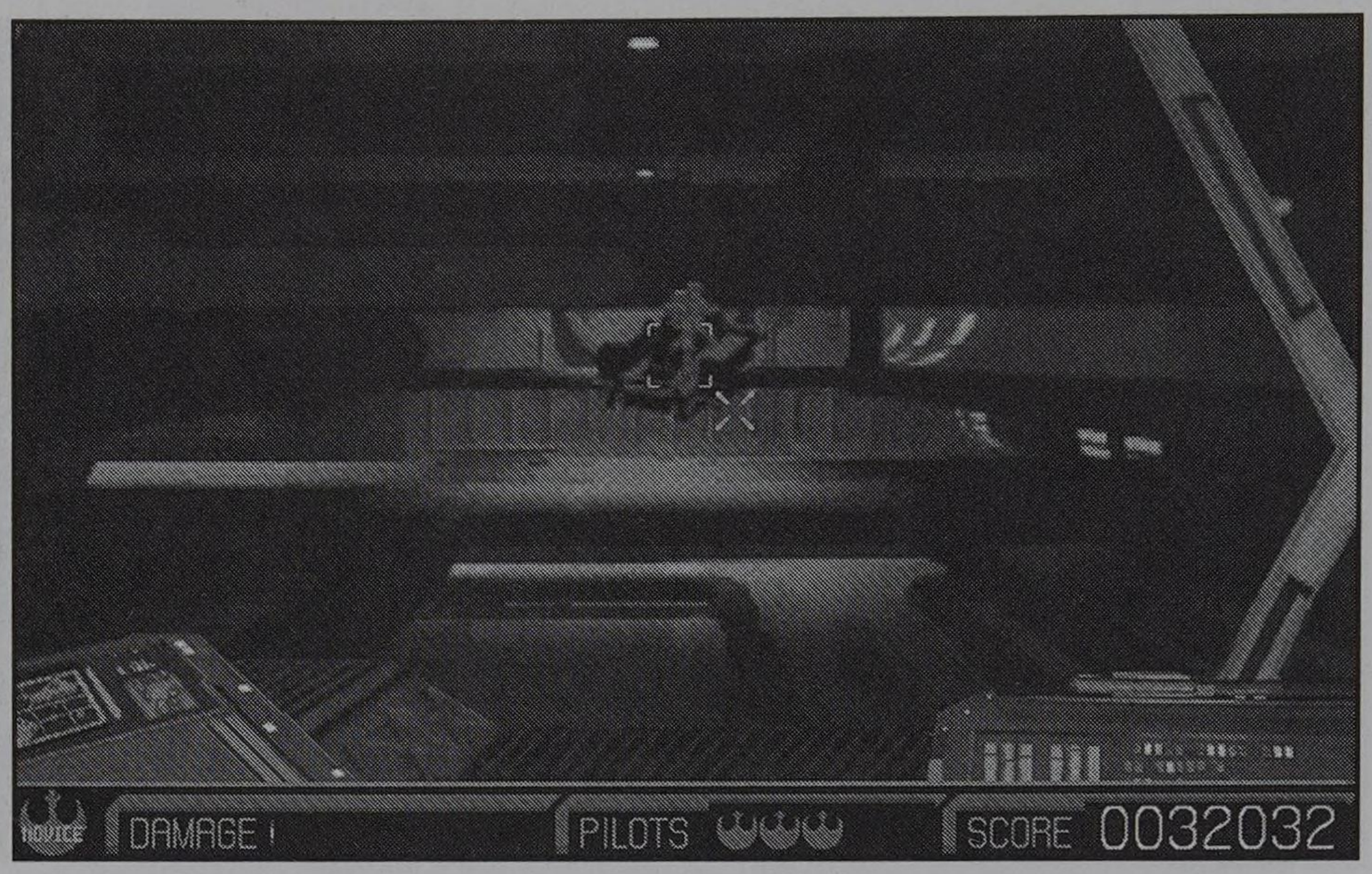


At last you can fire at these three shields, then six more, and six more, and you're finally out of that tunnel.

But your work is not over yet. In this pipe area, there are two hoversleds that will come at you from the upper right, so get ready to aim that way. They will shoot at you. They can't get past you, but they will continue to fire.



Believe it or not, there's a pause here before a sled comes at you from the upper right. Aim and kill.

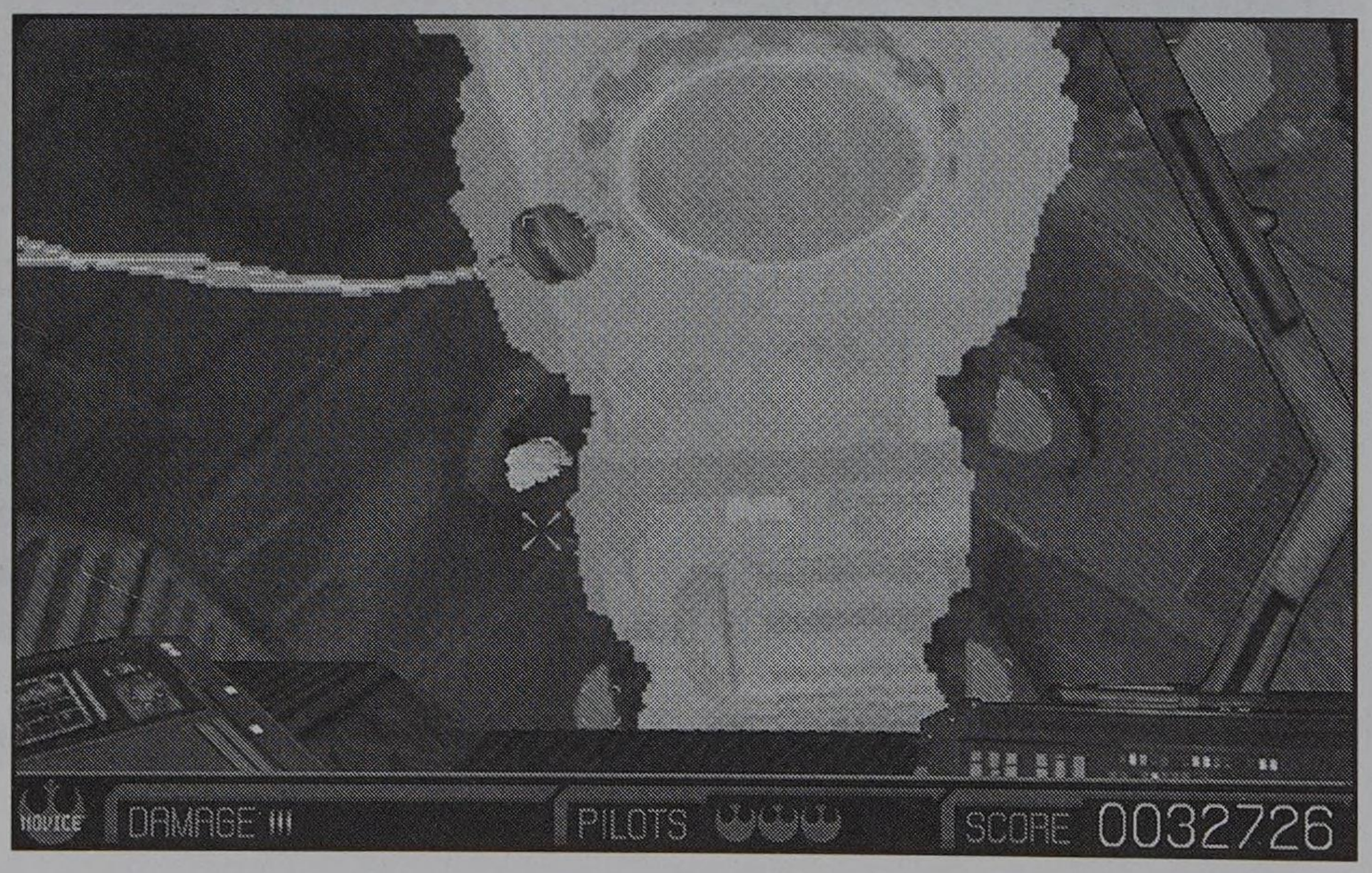


When you see this horizontal bar before the last tunnel opening, pull up. Once you're into the tunnel, you don't have to touch anything until you enter the core of the tunnel. Pull up and right to find the safe flight path through the tunnel.

— Matthew Azeveda

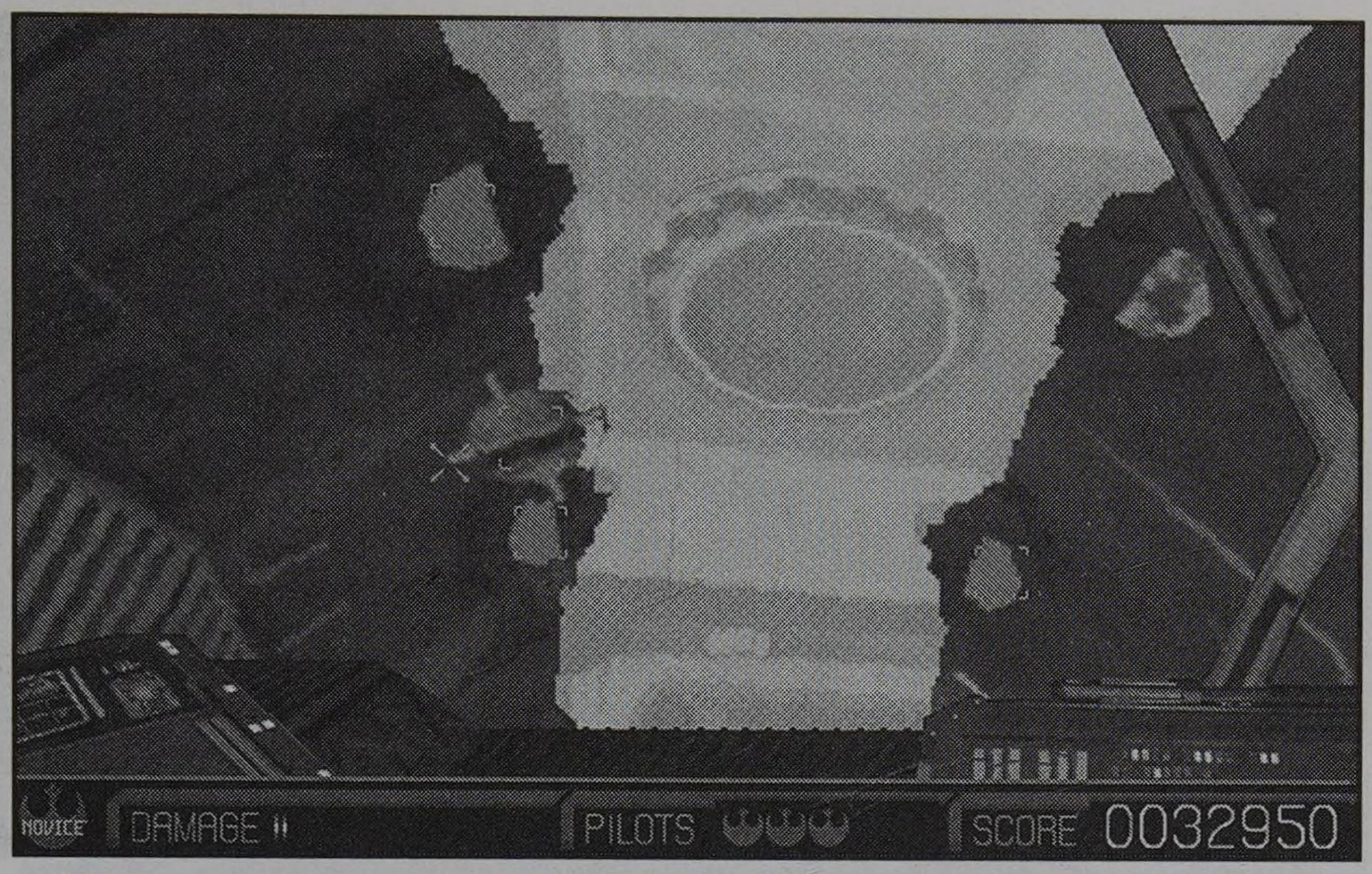
Stage 3

You're almost finished. The last task is to shoot out the focusing beam in the ship's reactor. This is fairly simple and just requires that you keep shooting while flying in a loop.



Your only threat is a single droid that shoots arcs of lightning. Blast it right away so that you can concentrate on the shields because you gain a significant time bonus if you can get them all on the first pass — it is possible. Some people find this easier to do with a mouse because you can pinpoint the targets better, but it's doable with a joystick.

— Albert Chen



The droid regenerates with each loop that you take. Your first target in each loop should be the droid. By now, you may be severely in the red zone, damagewise, but there's hope. If you shoot the droid, you can continue to loop this section until you recover completely. This is one of the safest points in the whole game — plus you gain extra points for destroying the droid over and over — and, who knows, you may even get an extra life in here.

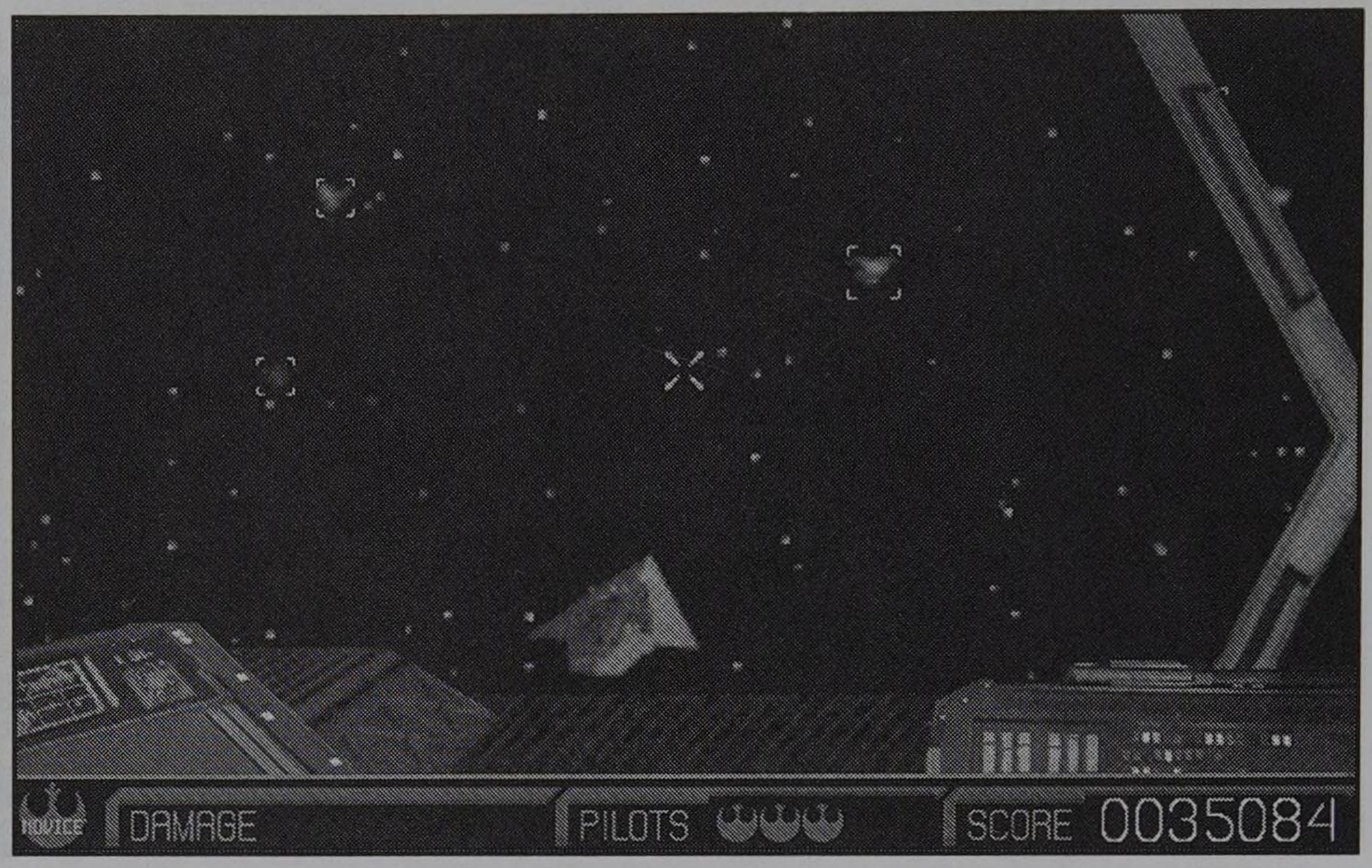
— Matthew Azeveda

You will loop and loop until you get all of the shields. When you get them, you exit automatically through a tunnel.

— Chris Snyder

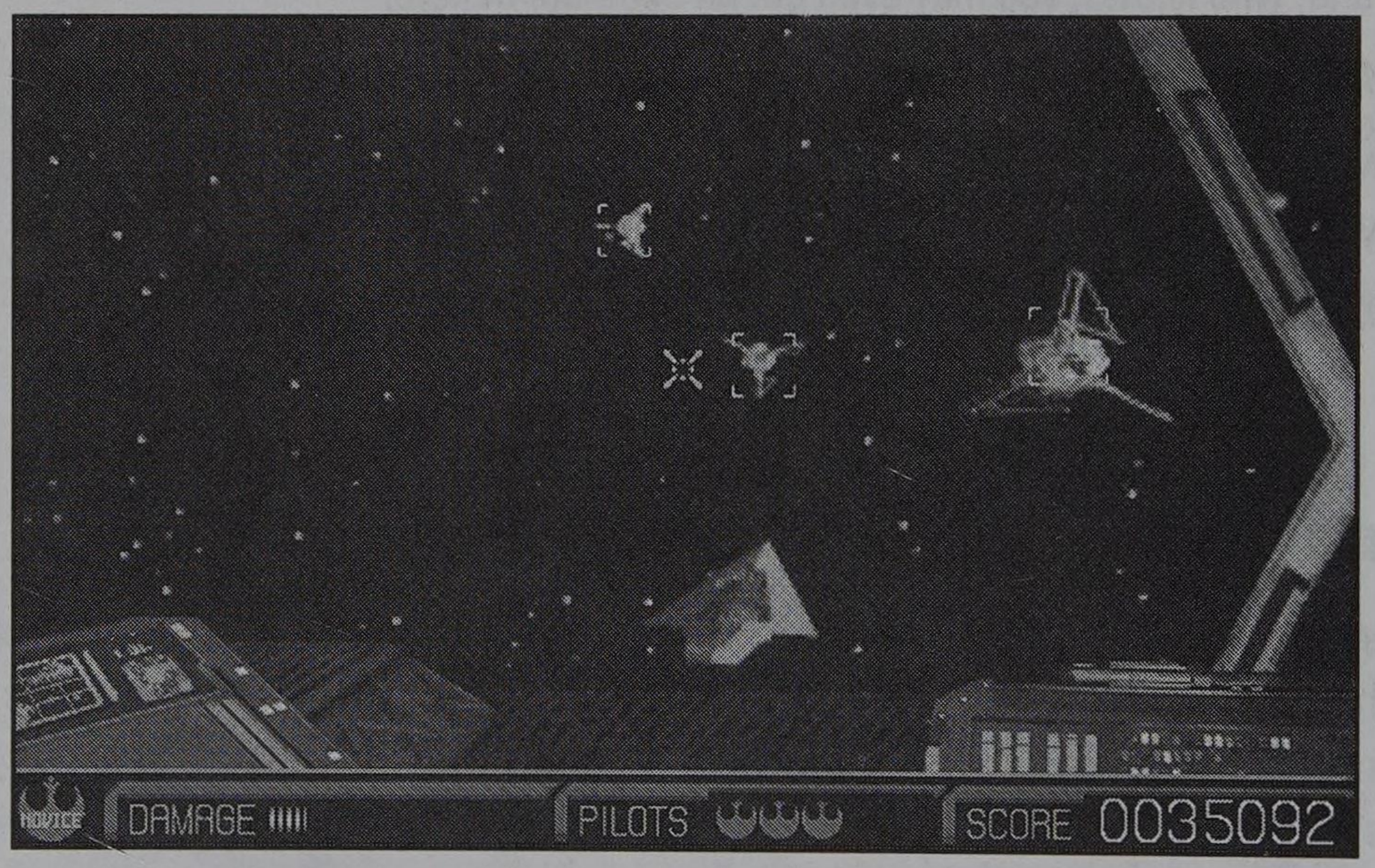
CHAPTER 14: TIE ATTACK

This chapter is similar to Chapters 1 and 8 — the shooting-gallery, in-cockpit chapters — but it's tougher. Because you're near the end, however, you're pumped up, invigorated. As Brad Grantham says, "When I've gotten this far, it gives me that warm fuzzy feeling — I'm about to bust this thing." The chapter is one long stage, and you're flying a modified phantom V-38 TIE fighter — the official name for the cloaking TIE fighters. What you're trying to do is get your cloaking device to work. Meanwhile, the cloaking devices are working on the enemy TIEs just fine. You can see them at a distance, then they disappear, then they decloak and reappear right before you — firing at you like mad.



It's absolutely vital that you shoot these TIEs when they are far away. It's best to destroy them from a distance. If you can't, don't miss them when they reappear.

— Matthew Azeveda

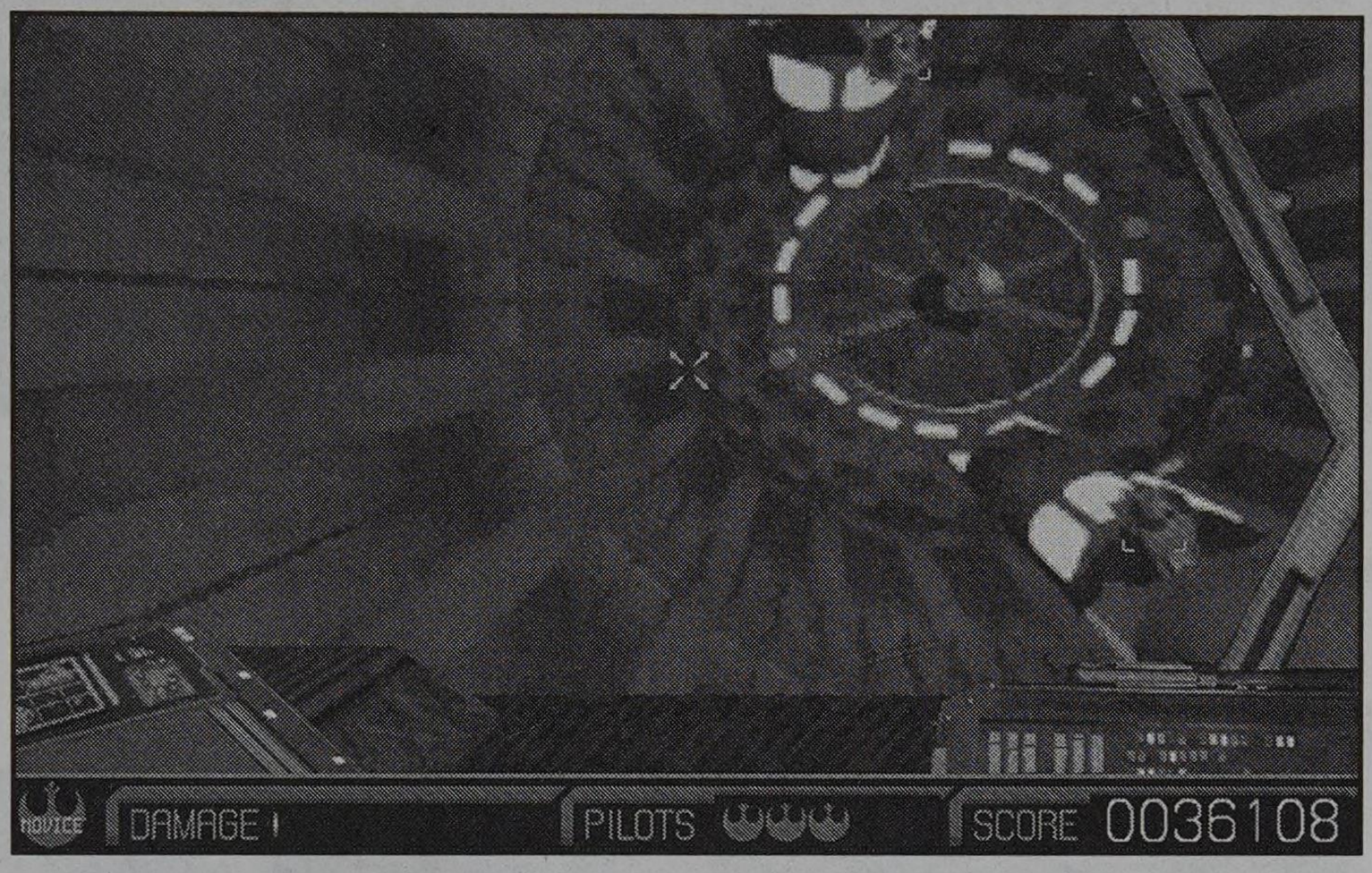


Shoot the TIEs in groups as well as at a distance to make your bursts more efficient. As with all airborne targets, it's best to focus on one ship at a time and be certain of the kill before you turn to the next one. A good time to get more than one TIE at a time is when one decloaks right near you and there's another lined up with it in the distance.

— Chris Snyder

CHAPTER 15: IMDAAR ALPHA

The last gauntlet, and Vince Lee saved the best for last. It is arguably the hardest level, particularly the stage with the robotic arms. Your goal is to destroy the factory that manufactures the phantom V-38s. This level works equally well with either the mouse or joystick.

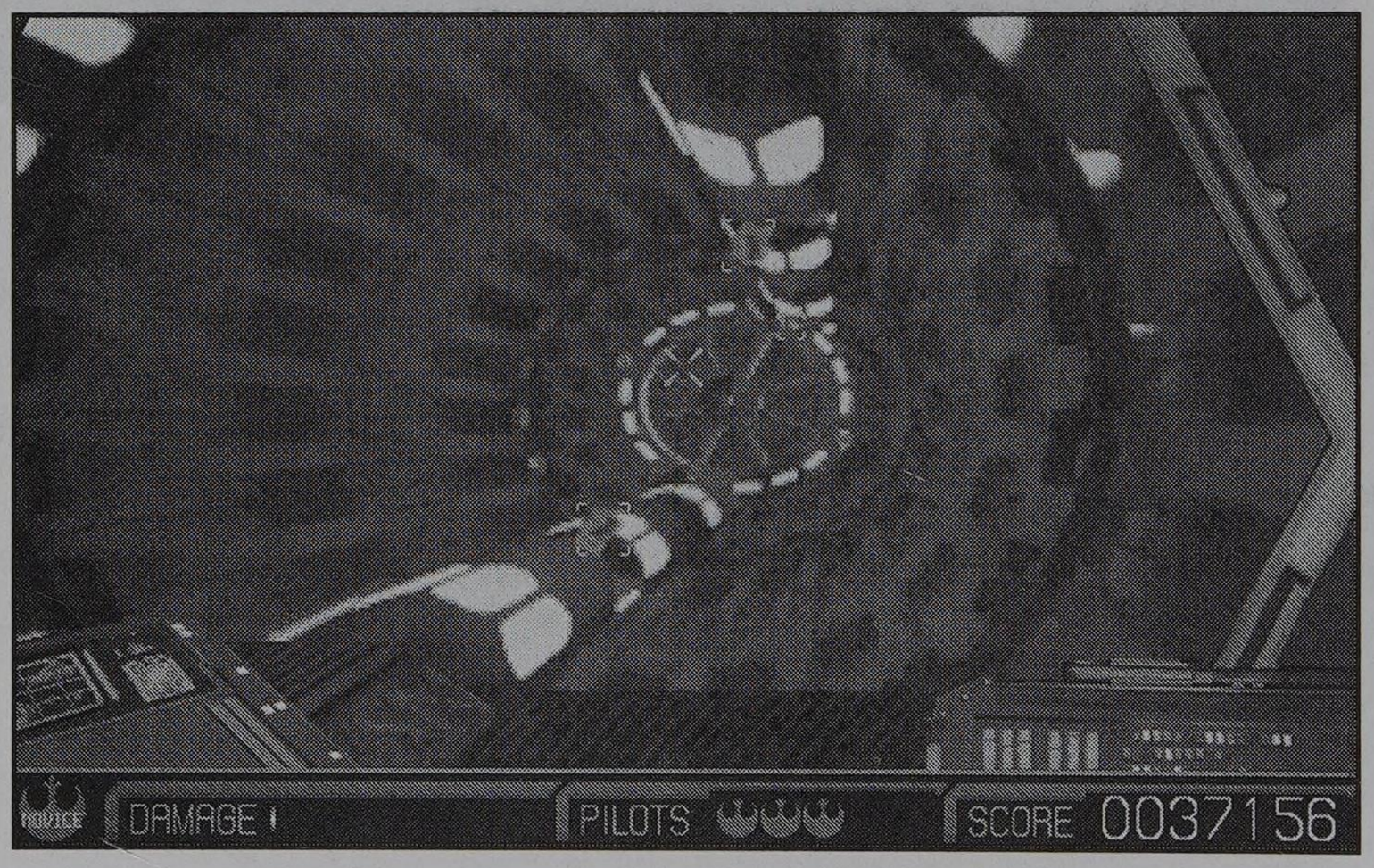


Stage 1

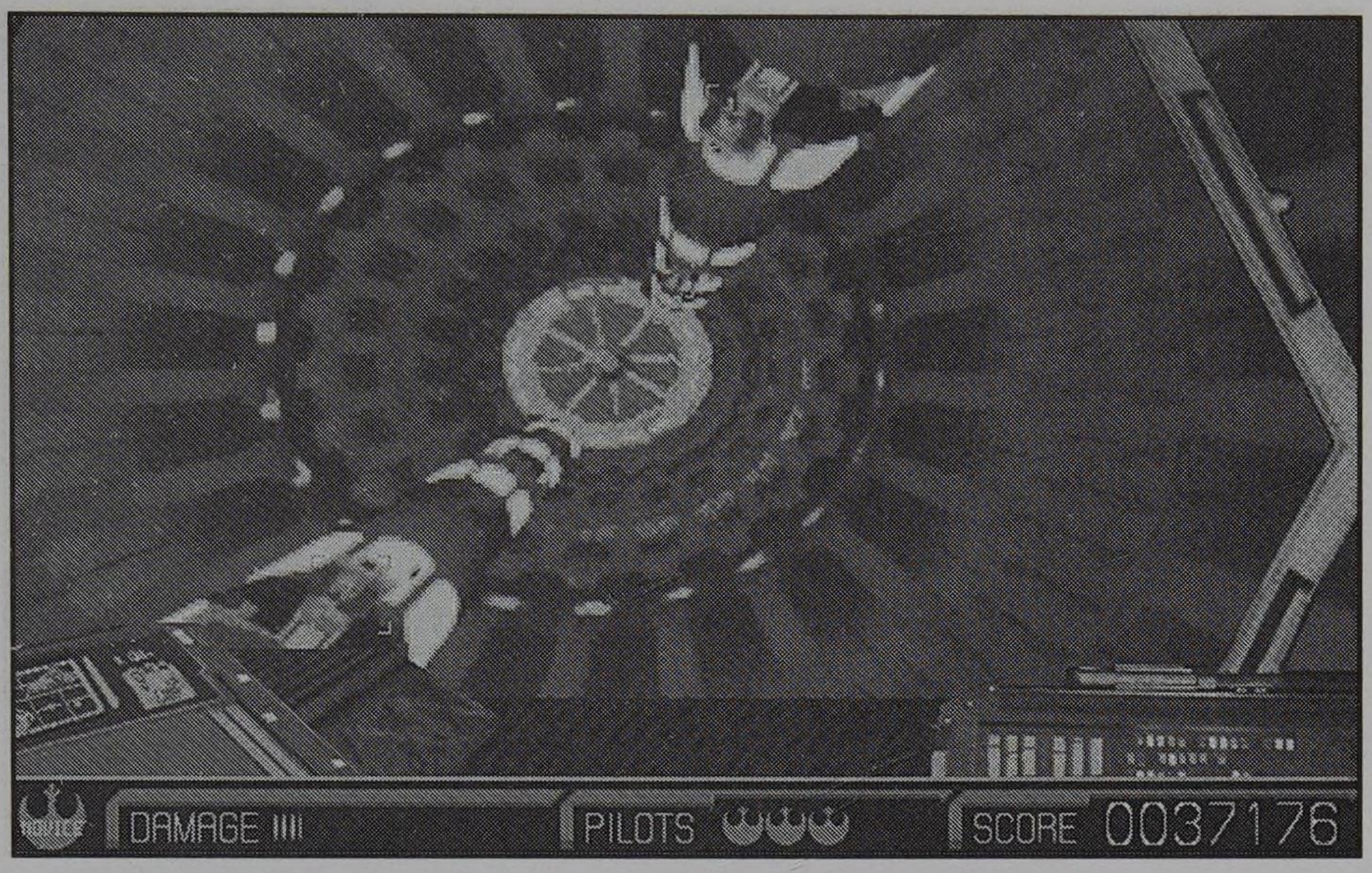
To penetrate the core of the facility, you initially fly through a tunnel with a line of turrets above and below you. The turrets are evenly spaced so you can readily knock out as many as you can — and be sure to knock them out. They do more damage if you fly past them than if they shoot you. Accuracy is a matter of survival.

— Chris Snyder

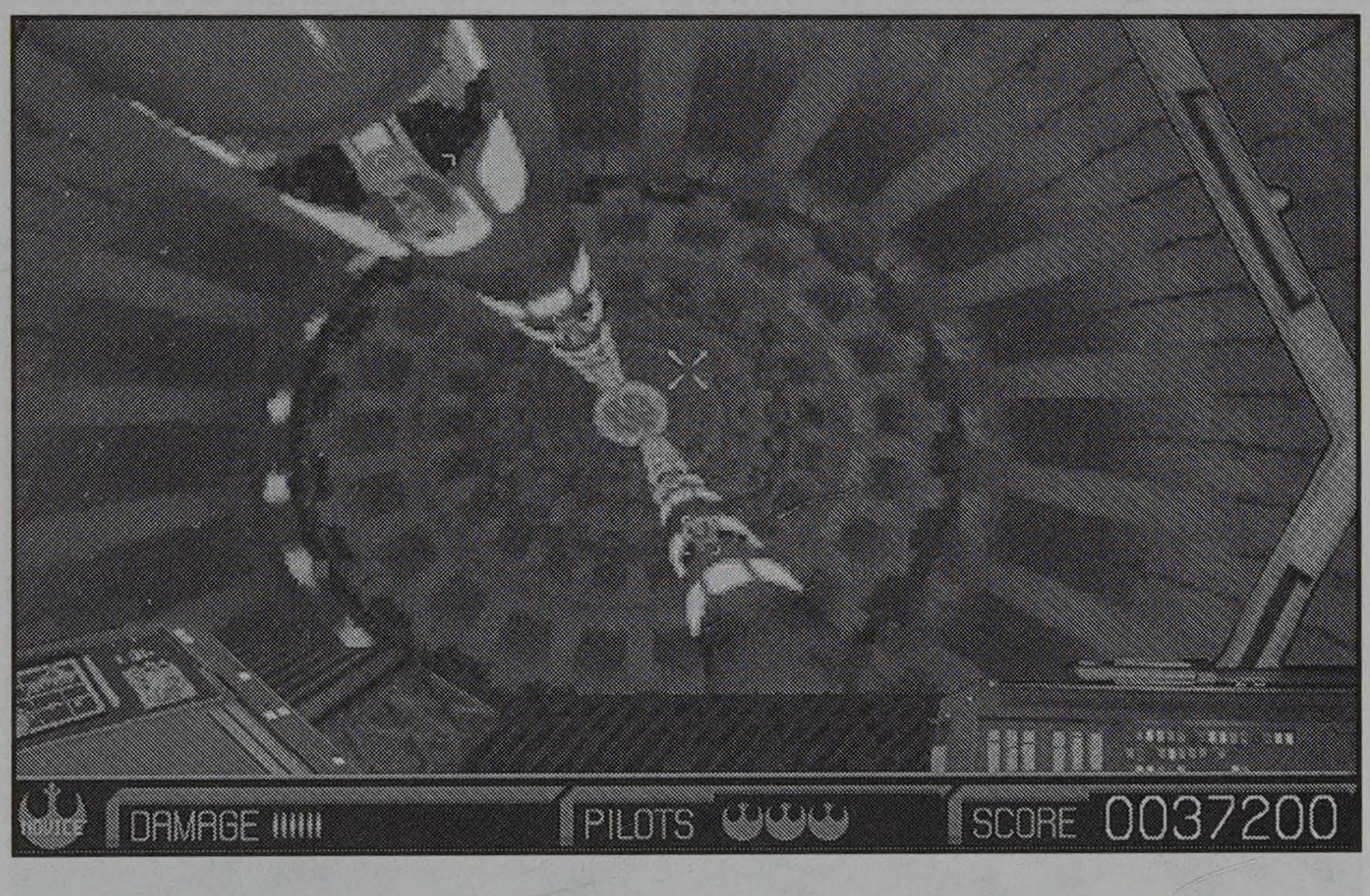
The flight path through these tunnels to the core corkscrews back and forth, left to right, within the tunnel. The pattern starts with a right turn and left turn, then you're into a new tunnel.



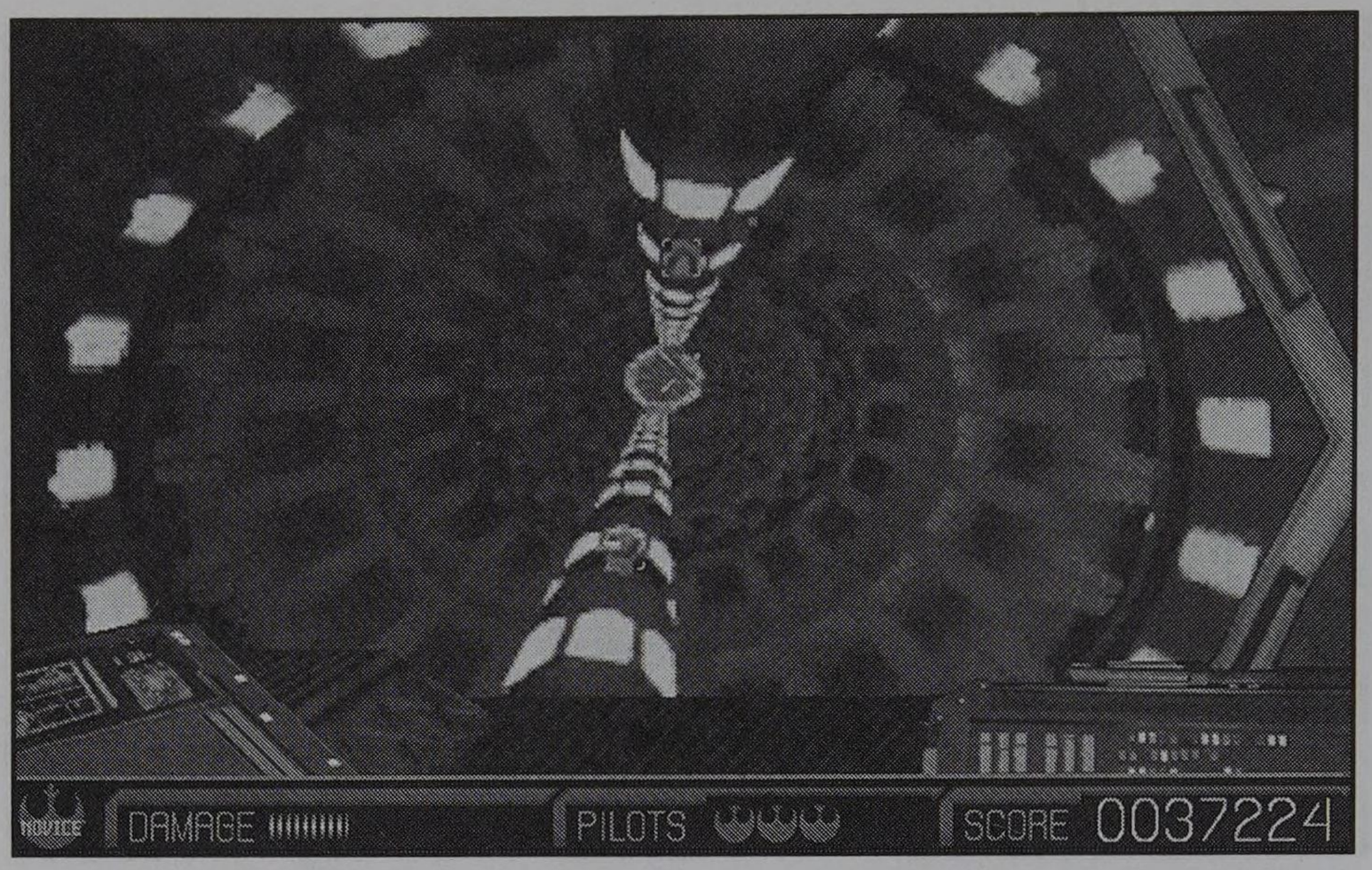
Center your cursor and shoot these turrets in a wave pattern, nice and even, up and down, and you can get most of them . Then make a right turn and a left turn...



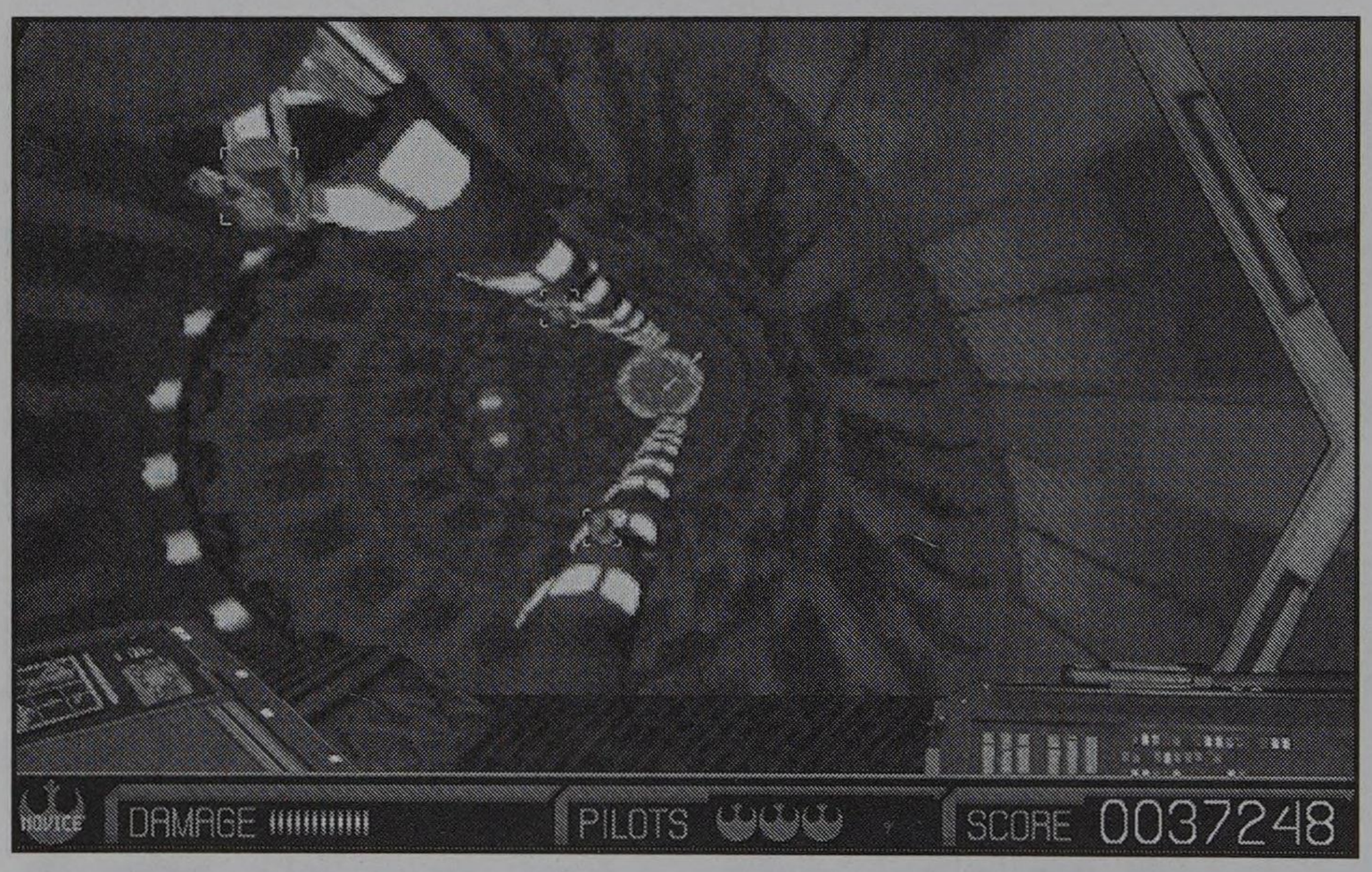
...and you're in a second tunnel with the same turrets. Shoot them, turn left, then right.



You're in a third tunnel with more turrets. Shoot them, turn left and right...



...and, yes, it's a fourth tunnel with more turrets. Shoot, turn right and left this time...



...and — surprise! — it's a fifth tunnel with more turrets. For one last time, shoot, turn left, then right, and you're in the last tunnel to the core.

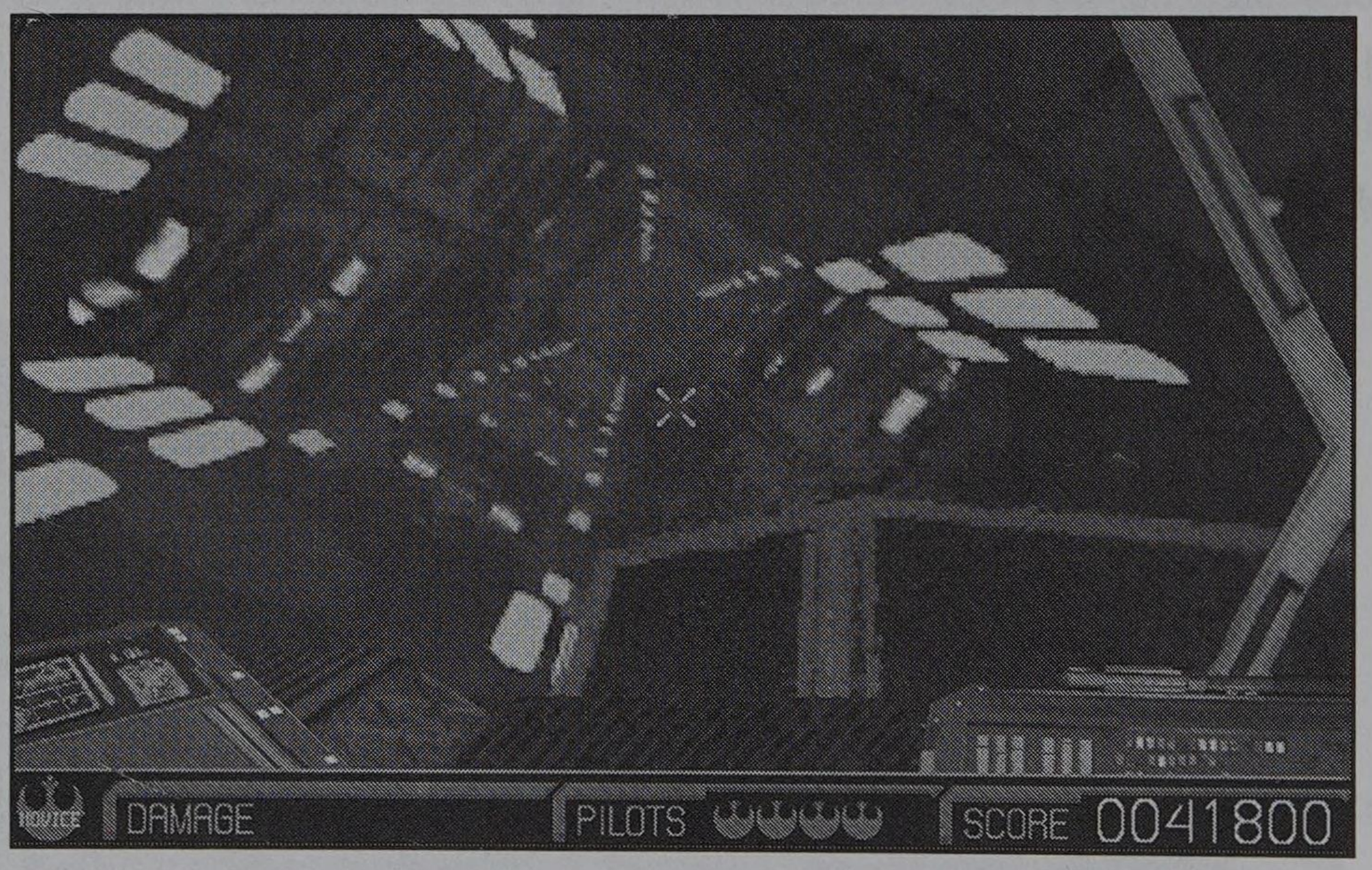
Stage 2

You're in the fabrication area where the phantom TIEs are pieced together. This may be the hardest section in the game. It's very intense. You must avoid robotic arms that move suddenly at the last moment before you reach them. You have to make a split-second decision about where you want to go. These robot arms inflict a lot of damage, and there will be many turrets shooting at you in the last stage. Learn the pattern, shoot the targets, and keep practicing until you get it right.

— Matthew Azeveda

This area, just before the robotic arms, requires you to fly down, then up, then to the upper left, then down, then up, and down again. After a preset right turn, you're in a new room with those auto arms.

To get through, first go to the upper left and shoot attack drones that come at you (if they get past, they won't damage you). Concentrate on the drones. They tend to come at you from the center, so keep your cross-hairs in the center to vanquish them.



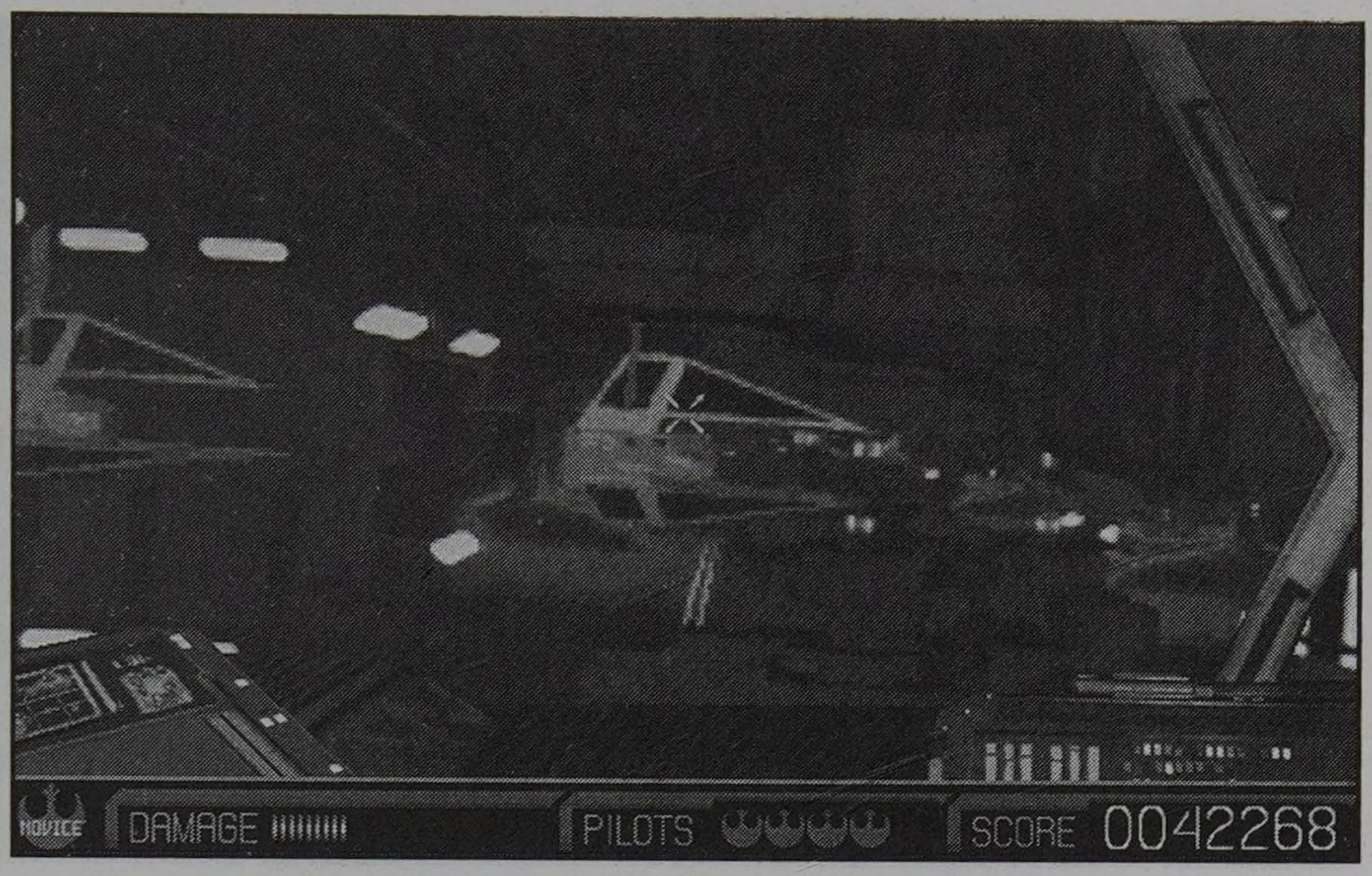
At the end of the room, there is another V-38 flying out at you. Go to the lower right...

...and another arm comes out, but you don't have to do anything. It seems like you should dive down, but stay level and you will get past it.

A second arm also won't hurt you; but this third arm will. Go down...

...pull up at this fourth arm, then dip down for the fifth arm before you make a sweeping left turn.

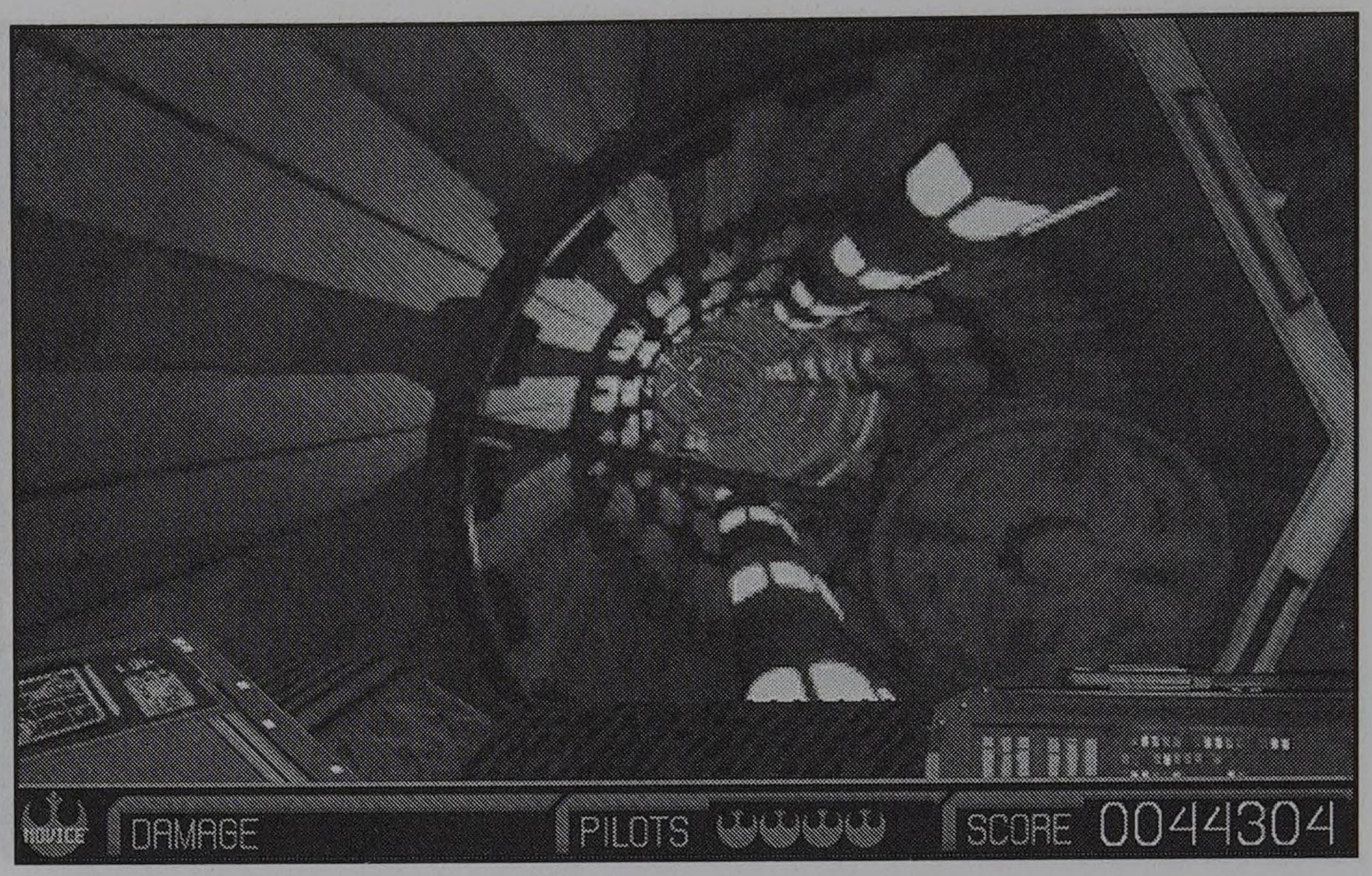
Another V-38 is pulling out — move to the upper left where you can shoot more attack drones. Stay centered and shoot away.



There's another V-38. Move to the upper left; now you have to do the limbo with more arms. Go down to go under the first one and up to go over the second. Then you cross over to the right side, and it's under, under, and over the last three arms. Finally you're in the core.

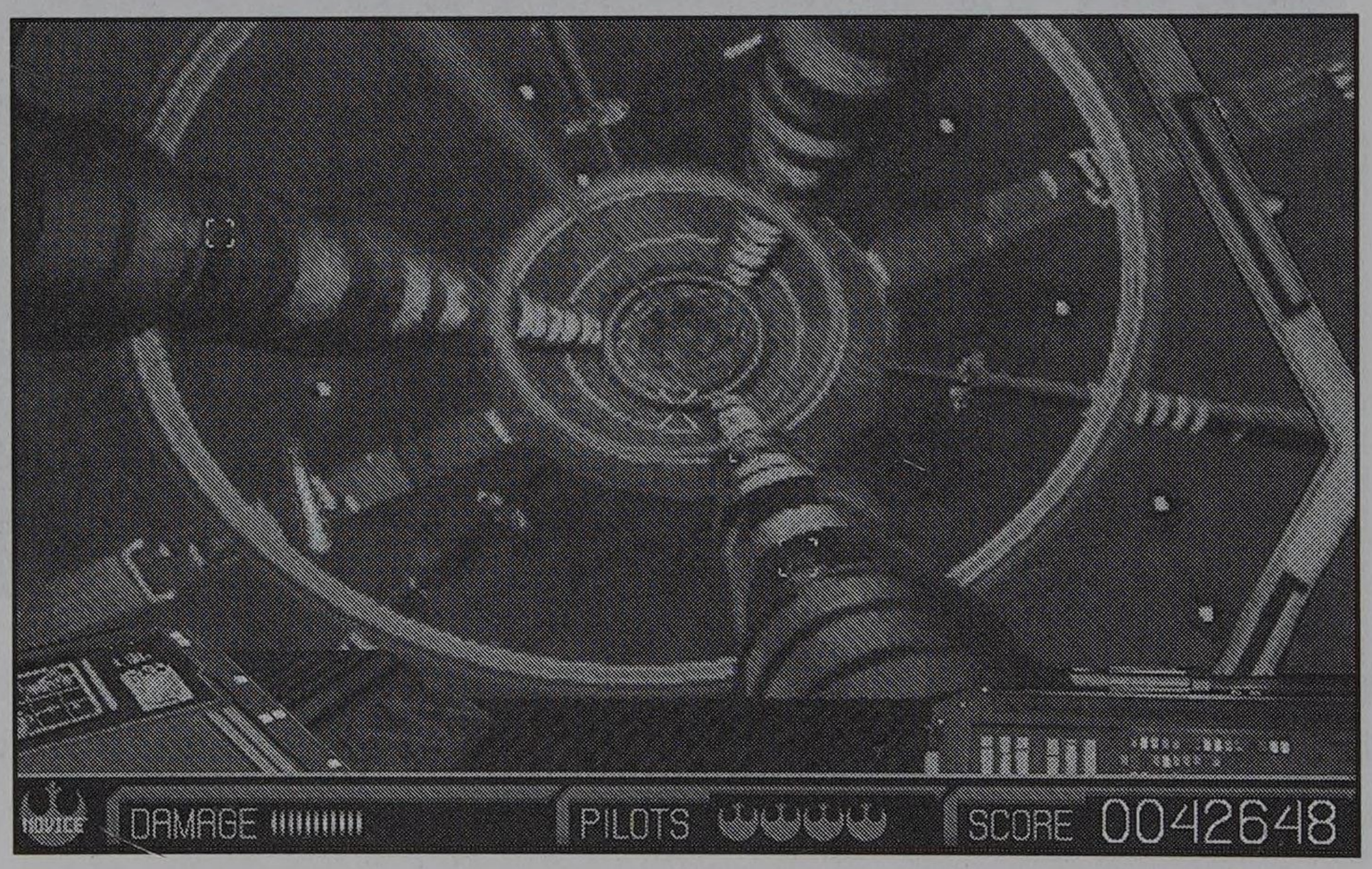
Stage 3

It's time to take the core out of this facility and destroy every last vestige of the infamous Phantom V-38 TIE fighters — except your own of course. You get to make a hasty escape, if you can.



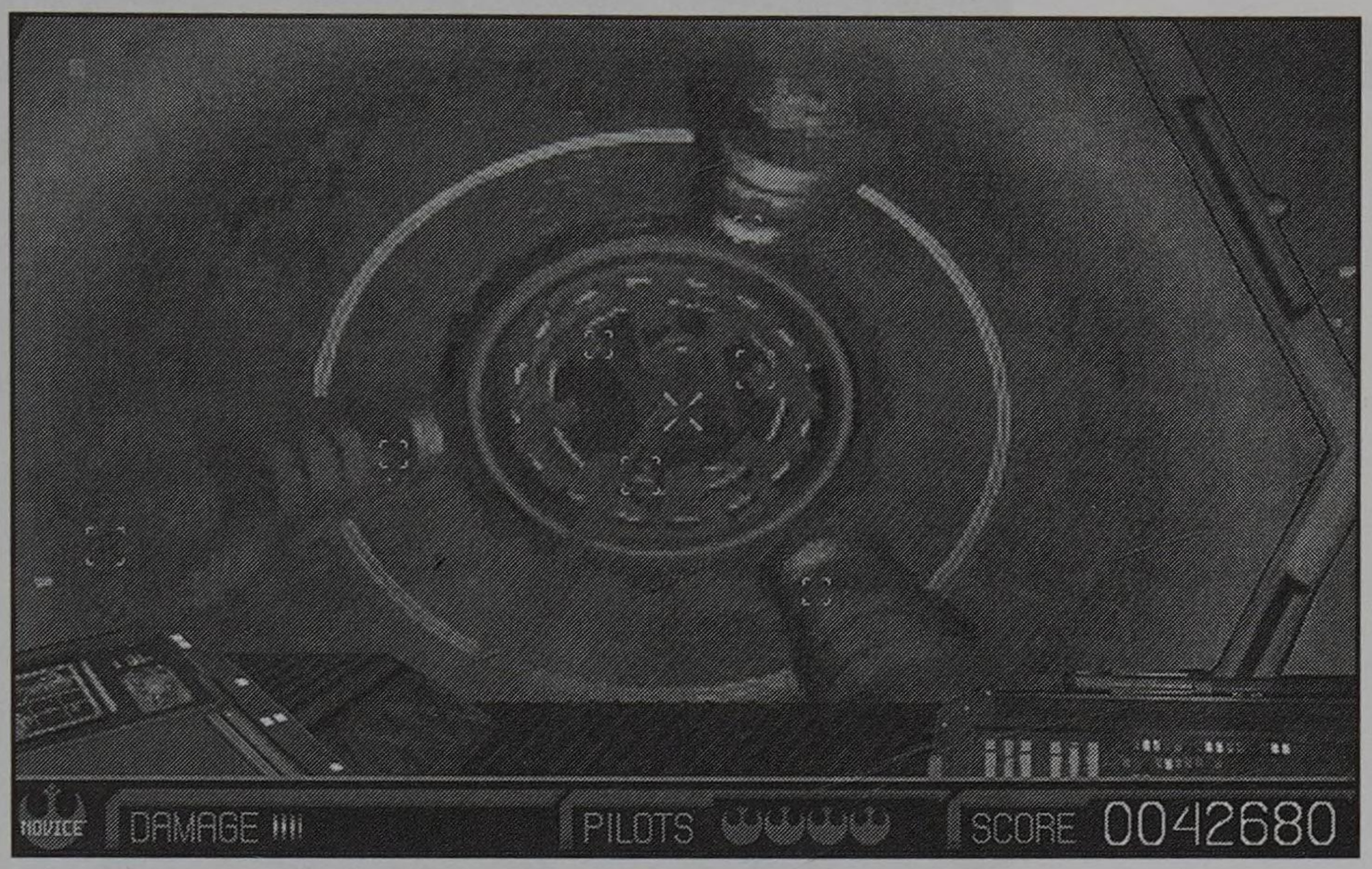
The first tunnel immediately presents you with a horizontal bar directly in front of you. You want to go up over it.

— *Sean Matheis*



Voila! Three gun turrets along three columns. Take them out as you see them. You can only see the ones that are closest to you, and they cluster in groups of two on each column. Focus on systematically taking out each group before you go to the next column. The turrets will shoot you if you don't get them, and they will hurt you, but don't fret if you miss — concentrate on the ones in front of you.

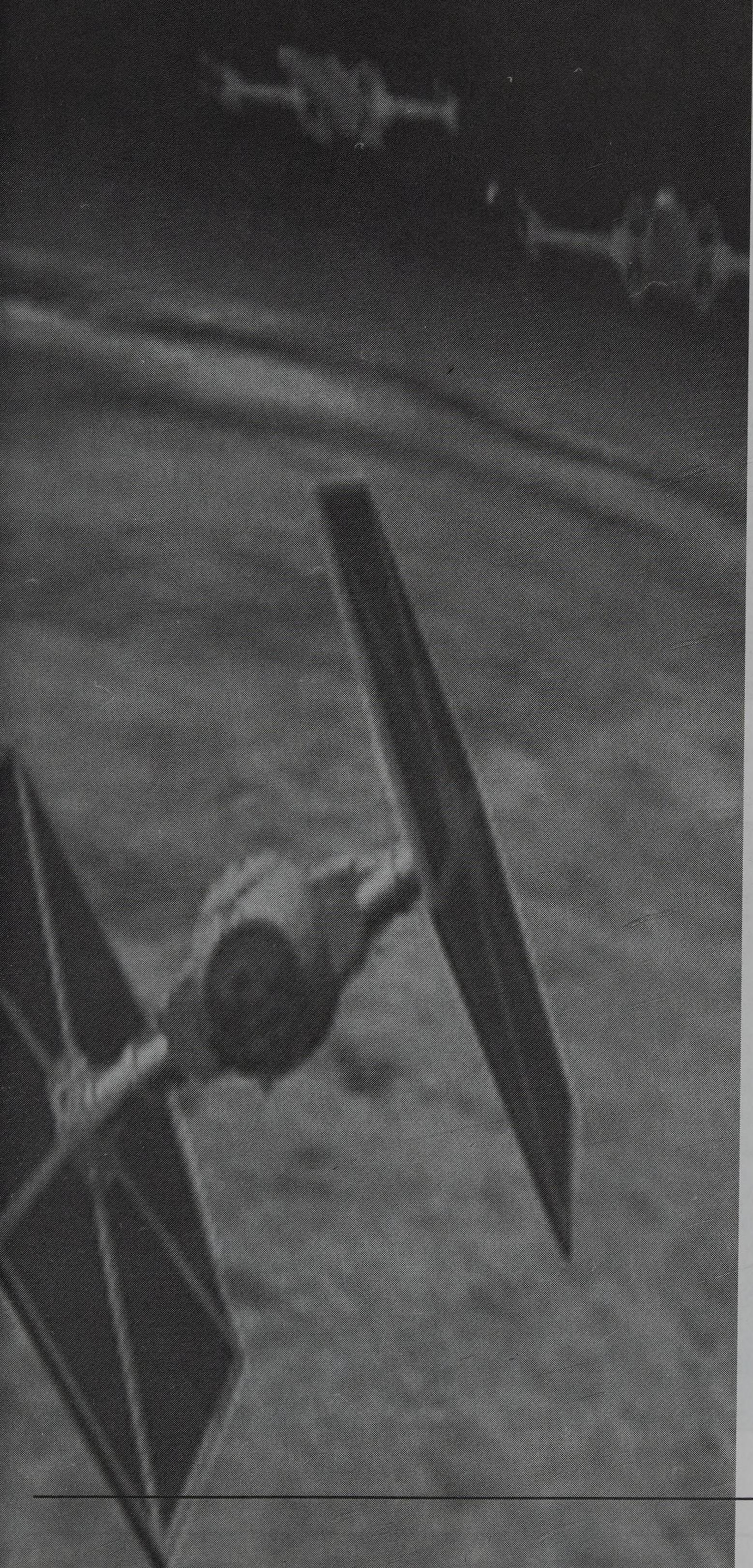
— *Sean Matheis*



At the end of the beam focuser are three spots that you have to hit to knock out the beam focuser. If you don't succeed in hitting them, you die, and it's not pleasant. The trick is to shoot out the turrets before you get to these because they will pester and distract you mercilessly. You are probably in the red damage area by now, so you can't afford such pestilence. Taking them out quickly vastly increases your chances for survival.

— Chris Snyder

Once you take out the beam focuser, you're home free! Congratulations on saving the Rebel Alliance!



CHAPTER 3

STOP BEING DIFFICULT

Stop Being Difficult

Are you all thumbs when it comes to arcade shoot-em-ups? Did you buy Rebel Assault II *just to check out the sleek graphics, amazing video, and John Williams'* Star Wars *score? Or are you the man-among-boys gamer, a joystick stud who can't believe that Vince Lee made the Expert setting so darn wimpy? In either case, the Difficulty Editor, a first for LucasArts, lets you alter 21 attributes so you can fine-tune the play to meet your demanding (or undemanding) standards.*

If thinking about roll rates and snap distances makes your brain spin, however, don't fret. At the end of this chapter is a section entitled "Difficulty Settings of the Jedi Testers."

It gives you a handful of custom settings that you can transfer to your game when you've exhausted the default levels.

WHAT ARE ALL THESE NUMBERS ANYWAY?

The game comes with four difficulty levels — Beginner, Novice, Standard, and Expert — that you cannot change. The difficulty configurations are shown here to give you a clear picture of how they differ. The attributes run down the left side of the chart; the chapter numbers run across the top. One of the first things you

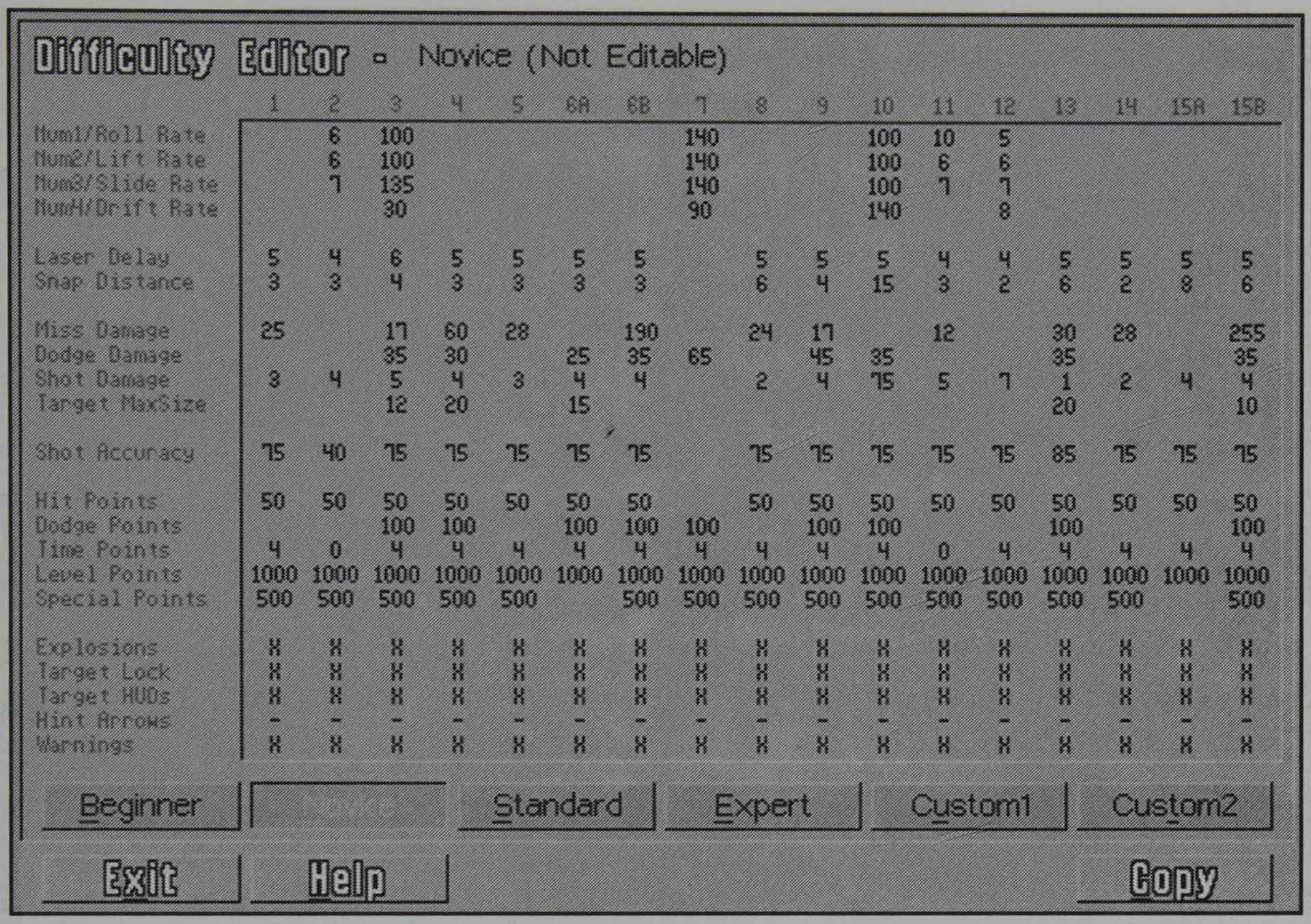
Difficulty Editor - Beginner (Not Editable)

	1	2	3	4	5	6A	6B	7	8	9	10	11	12	13	14	15A	15B
Num1/Roll Rate		5	90					120			90	10	5				
Num2/Lift Rate		5	90					120			90	6	6				
Num3/Slide Rate		6	120					120			90	7	7				
NumH/Drift Rate			25					75			135		8				
Laser Delay	5	4	6	5	5	5	5		5	5	5	4	4	5	5	5	5
Snap Distance	5	5	5	4	5	5	5		8	6	20	5	2	7	3	9	6
Miss Damage	15		15	18	18		180		21	15		10		20	24		255
Dodge Damage			30	17		19	27	40		30	30			30			30
Shot Damage	2	2	3	2	3	2	3		2	4	70	5	6	1	2	3	4
Target MaxSize			12	20		15								20			10
Shot Accuracy	75	40	75	75	75	75	75		75	60	75	65	65	85	75	75	75
Hit Points	25	25	25	25	25	25	25		25	25	25	25	25	25	25	25	25
Dodge Points			50	50		50	50	50		50	50			50			50
Time Points	2	0	2	2	2	2	2	2	2	2	2	0	2	2	2	2	2
Level Points	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500
Special Points	250	250	250	250	250		250	250	250	250	250	250	250	250	250		250
Explosions	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Target Lock	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Target HUDs	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Hint Arrows	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Warnings	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Novice | Standard | Expert | Custom1 | Custom2

Exit | Help | Copy

Beginner is for those who aren't familiar with* Rebel II *at all.



Novice is for those new to action games.

may notice is that not every attribute applies to every chapter, and some attributes are the same in every chapter regardless of the difficulty level.

LucasArts created the Beginner and Expert settings first, then tweaked those to come up with the Novice and Standard configurations.

The Beginner setting is for those who found the Easy setting in *Rebel I* too difficult. "It's for people who don't play computer games," Lee said. "It's easy, but there's still a bit of a challenge."

The Novice setting is for those who know their way around computer games but aren't hard-core action gamers. "The jump to Novice is for people who are not terrifically good at action games," Lee said.

The Standard setting is made for someone experienced in shoot-em-ups. "You can't relax through it," Lee said. "You have to concentrate."

Expert is for the die-hard joystick jockeys. "We found the best people in testing at action games and made sure they found it challenging," Lee said.

The following section details the parameters you can tweak to create your own difficulty settings.

ADJUSTING YOUR FLIGHT PATH

The following rates, which range from 0 to 500, let you adjust the maneuvering difficulty in the flight chapters. Each rate is explained individually, but if you set all four rates to 0, you make the game ridiculously easy because your ship will remain in the center of the flight path no matter what you do to the joystick. Notice that the designers on Expert level never go higher than 165.

Roll Rate Speed of turns

The roll rate determines how fast your ship will turn from side to side in response to right and left movements on the joystick. The higher the setting, the quicker (and more uncontrollable) the turn.

Difficulty Editor ▫ Standard (Not Editable)

	1	2	3	4	5	6A	6B	7	8	9	10	11	12	13	14	15A	15B
Num1/Roll Rate		7	110					160			110	11	6				
Num2/Lift Rate		7	110					160			110	7	7				
Num3/Slide Rate		8	150					160			110	8	8				
NumH/Drift Rate			35					105			150		9				
Laser Delay	5	4	6	5	5	5	5		5	5	5	4	4	5	5	5	5
Snap Distance	2	2	2	2	2	1	1		4	3	14	2	1	5	1	7	6
Miss Damage	35		20	70	35		200		27	19		20		40	38		255
Dodge Damage			38	35		30	50	80		60	40			40			40
Shot Damage	5	6	7	6	4	6	4		3	7	100	6	10	2	4	5	5
Target MaxSize			12	20		15								15			5
Shot Accuracy	75	40	75	75	75	75	75		60	75	85	75	75	76	75	75	75
Hit Points	75	60	75	75	75	75	75		75	75	75	75	75	75	75	75	75
Dodge Points			150	150		150	150	150		150	150			150			150
Time Points	6	0	6	6	6	6	6	6	6	6	6	0	6	6	6	6	6
Level Points	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500
Special Points	750	750	750	750	750		750	750	750	750	750	750	750	750	750		750
Explosions	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Target Lock	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Target HUDs	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Hint Arrows	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Warnings	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Beginner | Novice | Standard | Expert | Custom1 | Custom2

Exit | Help | Copy

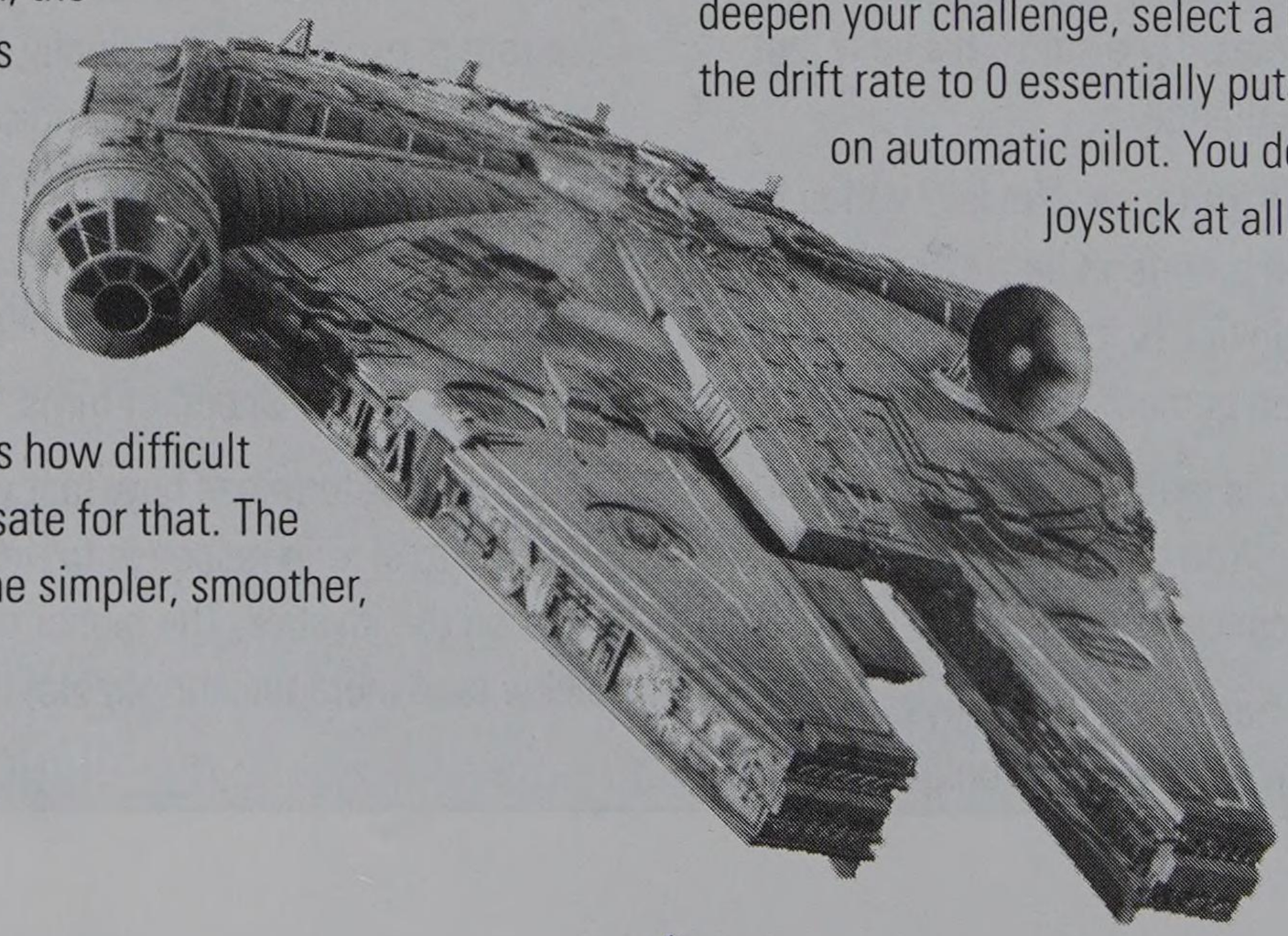
Standard is the setting most Rookie Ones will like.

Lift Rate Climbing force

The lift rate determines the speed with which your ship climbs and dives when you pull back or push forward on the joystick.

Slide Rate Side-turning force

Like the roll rate, the slide rate comes into play during left and right turns. Whereas the roll rate determines the speed of the turn, the slide rate determines the strength of the turn. If the on-screen animation shows there is a turn to the right, the slide rate determines how difficult it will be to compensate for that. The lower the number, the simpler, smoother, and easier the turn.



Drift Rate Sharpness in turns

The drift rate determines the sharpness of — and hence how difficult it is for your ship to follow — the preset flight path. You are essentially "fighting" this preset path, and the sharper the turns in the path, the tougher it becomes for you to follow. Therefore, choose a lower number to reduce the sharpness of the turns and to make the path easier for you to follow. To deepen your challenge, select a higher number. Setting the drift rate to 0 essentially puts the game, flightwise, on automatic pilot. You don't have to touch the joystick at all.

Difficulty Editor ▫ Expert (Not Editable)

	1	2	3	4	5	6A	6B	7	8	9	10	11	12	13	14	15A	15B
Num1/Roll Rate		8	120					180			120	12	7				
Num2/Lift Rate		8	120					180			120	8	8				
Num3/Slide Rate		9	165					180			120	9	9				
NumH/Drift Rate			40					140			200		10				
Laser Delay	5	4	6	5	5	5	5		5	5	5	4	4	5	5	5	5
Snap Distance	1	0	1	1	1	0	0		2	2	8	0	0	4	0	8	8
Miss Damage	77		23	120	55	220	220		35	30		30		55	49		255
Dodge Damage			42	50		50	90	90		75	50			55			45
Shot Damage	7	7	12	16	4	15	15		3	20	110	7	13	5	4	10	8
Target MaxSize			10	10		15								12			5
Shot Accuracy	80	40	75	75	75	79	90		68	80	90	75	75	77	75	79	80
Hit Points	100	100	100	100	100	100	100		100	100	100	100	100	100	100	100	100
Dodge Points			200	200		200	200	200		200	200			200			200
Time Points	8	0	8	8	8	8	8	8	8	8	8	0	8	8	8	8	8
Level Points	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000
Special Points	1000	1000	1000	1000	1000		1000	1000	1000	1000	1000	1000	1000	1000	1000		1000
Explosions	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Target Lock	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Target HUDs	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hint Arrows	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Warnings	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Beginner | Novice | Standard | Custom1 | Custom2

Exit | Help | Copy

Expert is for the take-no-prisoners gamer.

ADJUSTING THE NUMBER OF ENEMY FORCES IN GROUND COMBAT

The ground-combat variable comes into play in Chapters 2, 11, and 12, the only levels in which Rookie One fights Imperial forces on land. You can control the base number of stormtroopers that you will encounter in each of the four "passes," or battle sections in these chapters. You can set the number of stormtroopers for each pass. The higher you make the number, the more difficult the level becomes, and vice versa. You can set the stormtrooper level between 1 and 500.

Num1 Enemies in pass 1

Num2 Enemies in pass 2

Num3 Enemies in pass 3

Num4 Enemies in pass 4

IMPROVING OR IMPAIRING YOUR SHOOTING ABILITY

For these three variables, the numerical range is from 0 to 10 frames for laser delay, 0 to 30 pixels for Snap Distance, and 0 to 50 for Target MaxSize. If you want to make shooting targets as easy as it can be, you would set Laser Delay to greater than 1, Snap Distance to 30, and Target MaxSize to 50.

Laser Delay How long (in frames) it takes lasers to reach their destination

The smaller the number, the easier the shooting because the laser response becomes more and more instantaneous — as soon as you fire, the target is hit if you've aimed correctly. You also don't have to lead the target as much.

The rule of thumb for *Rebel Assault II* is that the farther away your targets — TIE fighters, for example, in the flight chapters — the larger you want to make this number (7 or 8) for more realistic gameplay. On the ground levels, however, where the stormtroopers are relatively close to you, choose a lower number (4 or 5).

Snap Distance Sensitivity (in pixels) of Auto-Lockon

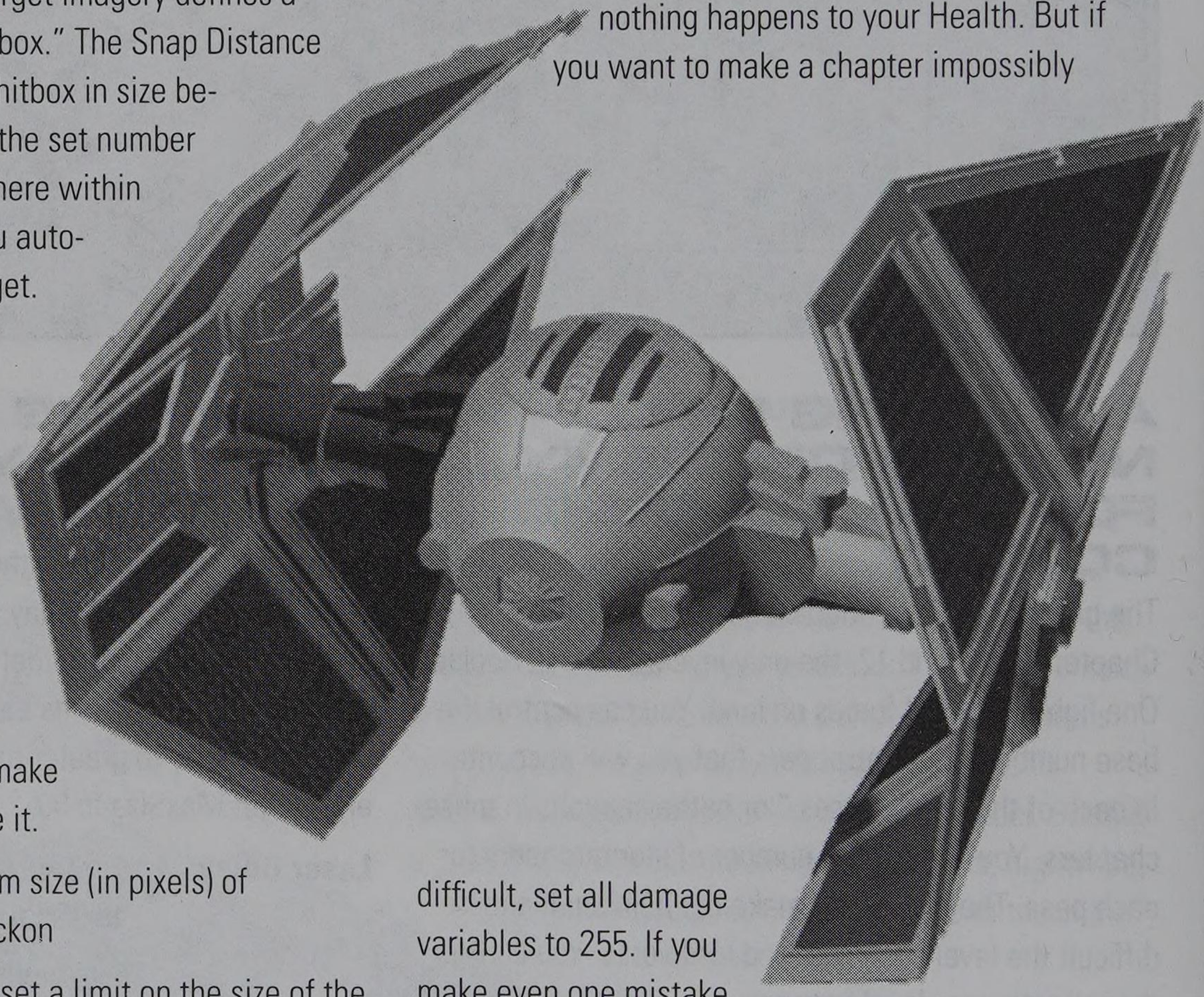
A target is approaching. You zero in on it with your crosshairs, and the computer beeps to tell you that you're locked on. But you don't have to aim directly at the target to lock on. The target imagery defines a shootable rectangle, or "hitbox." The Snap Distance can be used to enlarge the hitbox in size beyond the target imagery by the set number of screen pixels. Aim anywhere within that invisible hitbox and you automatically lock on to the target. The smaller the hitbox, the more difficult it is to shoot the target because your aim must be more exact (at 0, you must hit the target itself). Enlarge the hitbox and your aim can be more casual. To make the game easier, increase the Snap Distance number. To make the game tougher, decrease it.

Target MaxSize Maximum size (in pixels) of Auto-Lockon

Target Maxsize lets you set a limit on the size of the hitboxes from 0 to 50 pixels. Even if a target gets very large on screen, the hitbox you need to shoot never exceeds a square of the MaxSize pixels. If you set the MaxSize number to 1, you have to hit the middle of target. The more you increase it, the larger the hitbox.

INCREASING OR REDUCING DAMAGE

The numbers for the next four variables range from 0 to 256 (except for the last one, which ranges from 0 to 100). The first three variables determine the amount of damage that you absorb from different factors in the game. You start each chapter with full Health, which is set at 255 points. As you absorb damage, that number decreases. If it reaches 0, you crash or die. Therefore, if you want to be invulnerable, set all the damage variables to 0 because if you screw up, nothing happens to your Health. But if you want to make a chapter impossibly difficult, set all damage variables to 255. If you make even one mistake, you're gone.



For the last variable — enemies' shooting accuracy — set the rating to 0 if you want to simplify the game. The enemy becomes totally incompetent. A setting of 100, however, makes them the most accurate shooters in the galaxy.

Miss Damage Damage caused by missing a target

There are preset targets in each chapter that you are supposed to shoot. If you miss and zoom past the target (or it zooms past you), damage points are subtracted from your Health.

Dodge Damage Damage caused by not dodging an obstruction

Sometimes you're supposed to avoid or dodge obstacles — such as an asteroid — instead of shooting them. If you run into it, damage points are deducted from your Health.

Shot Damage Damage caused when shot

Not all targets are benign. When a TIE fighter hits you with laser fire, for example, damage points are deducted from Health.

Shot Accuracy Enemies' target accuracy

Shot accuracy determines the accuracy of enemy fire. It is measured from 0 to 100 percent, with 0 meaning that enemy lasers never hit you and 100 meaning that they hit you every time they shoot.

BOOSTING OR REDUCING SCORING

These variables are comparable to damage, but instead of deducting points from your Health, they add points to your score as you play. The maximum number for each of these variables is 5,000; the minimum number is 0. If you want to run up the score, set the numbers as high as you want.

Hit Points Points for shooting an enemy

Set Hit Points to a given number and you get that many points when you shoot an enemy target.

Dodge Points Points for dodging an obstruction

Set Dodge Points to a given number and you get that number of points if you successfully avoid an obstruction. (What qualifies as an obstruction has been established by the designers and can't be changed.)

Time Points Points for each time increment

You receive points for every second or so that you survive. The higher you set the number in this category, the more points you receive for each tick of the clock. This variable was designed primarily for the flight levels, where your forward motion is impossible to stop. Lee zeroed the number of points in stormtrooper levels because otherwise, you could just sit there gathering points as the clock runs on and on. You, of course, don't have that limitation. If you want to run up your score artificially, that's one way to do it.

Level Points Points for completing level

Each time you complete a chapter, you receive a bonus called Level Points. The lower the variable, the less points you receive, and vice versa. You receive more level points at harder preset difficulty settings.

Special Points Level-specific bonus points

When you accomplish things beyond what a typical person does, you get a bonus called Special Points. The designers determine what they are; you can only award higher or lower points for the accomplishment. In most chapters, special points are awarded for target accuracy and how many enemies you're able to hit. If you shoot with 100 percent accuracy, you might get triple the special points number. If you shoot with 97 percent accuracy, you might get twice the special points number.

CONFIGURING YOUR COMBAT SCREEN

The remaining variables do not directly affect your score or damage, they change the appearance of what you see on the screen, which can affect the gameplay. Essentially they are on and off "switches," so there are no numerical ratings for these variables, and they don't necessarily apply to all chapters.

Explosions Whether explosions are shown

Explosions are always on in *Rebel Assault II*. In *Rebel Assault*, designer Lee turned them off in the chapter in which you are shooting at the AT-ATs.

Target Lock Whether lasers lock on to targets

Do you like having hitboxes around enemy targets? If not, turn them off to make the Snap Distance and Target MaxSize variables unworkable. It makes the game much more difficult.

Target HUDs Whether targets are marked in HUD

In Expert mode, the target heads-up display (HUD) is turned off. That means that you don't see the illuminated squares around targets as they approach. You have to figure out on your own what's a target and what's not. It is much easier if you play with the HUD.

Hint Arrows Whether hint arrows appear to help you dodge obstacles

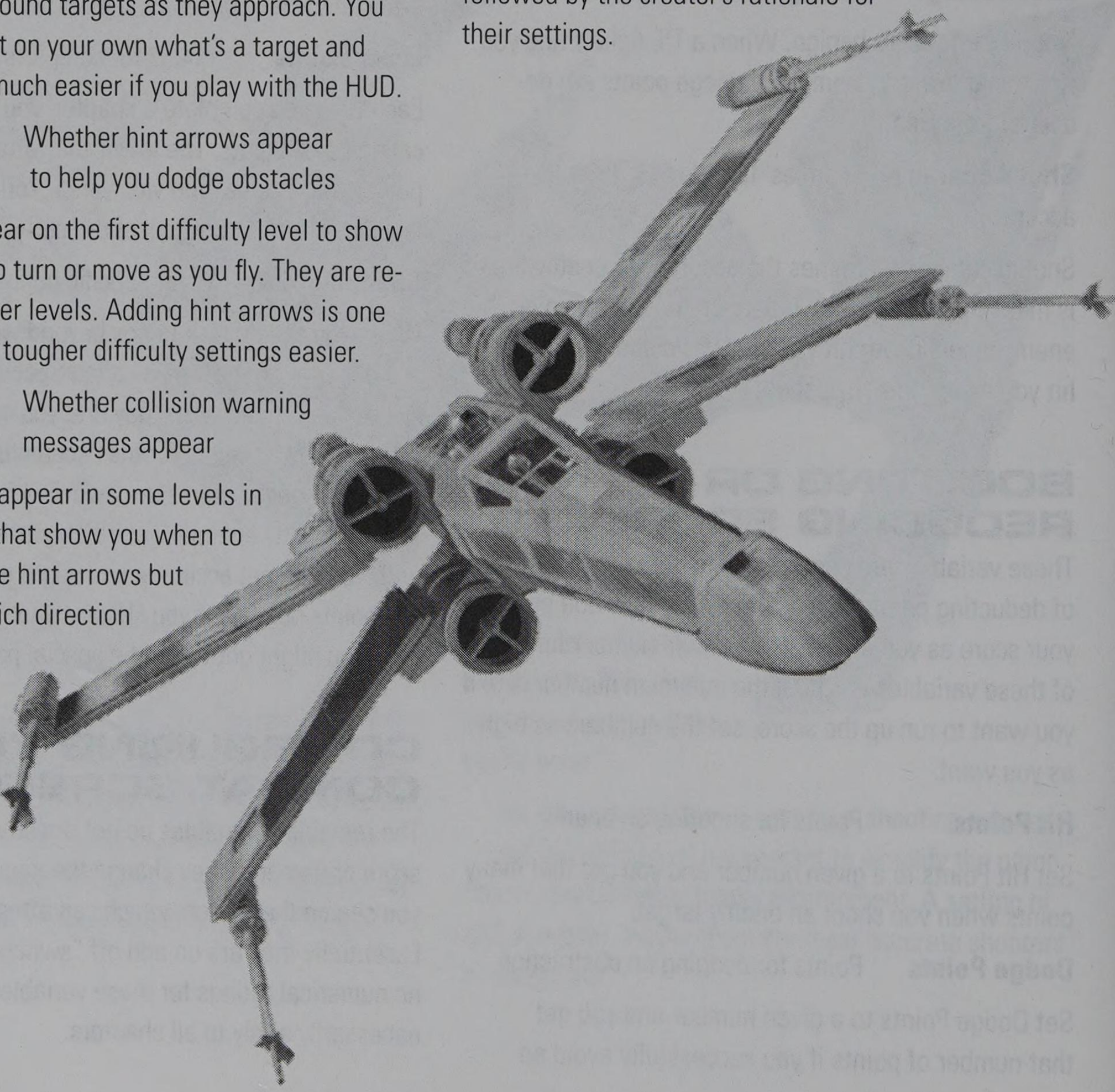
Hint arrows appear on the first difficulty level to show you which way to turn or move as you fly. They are removed for all other levels. Adding hint arrows is one way to make the tougher difficulty settings easier.

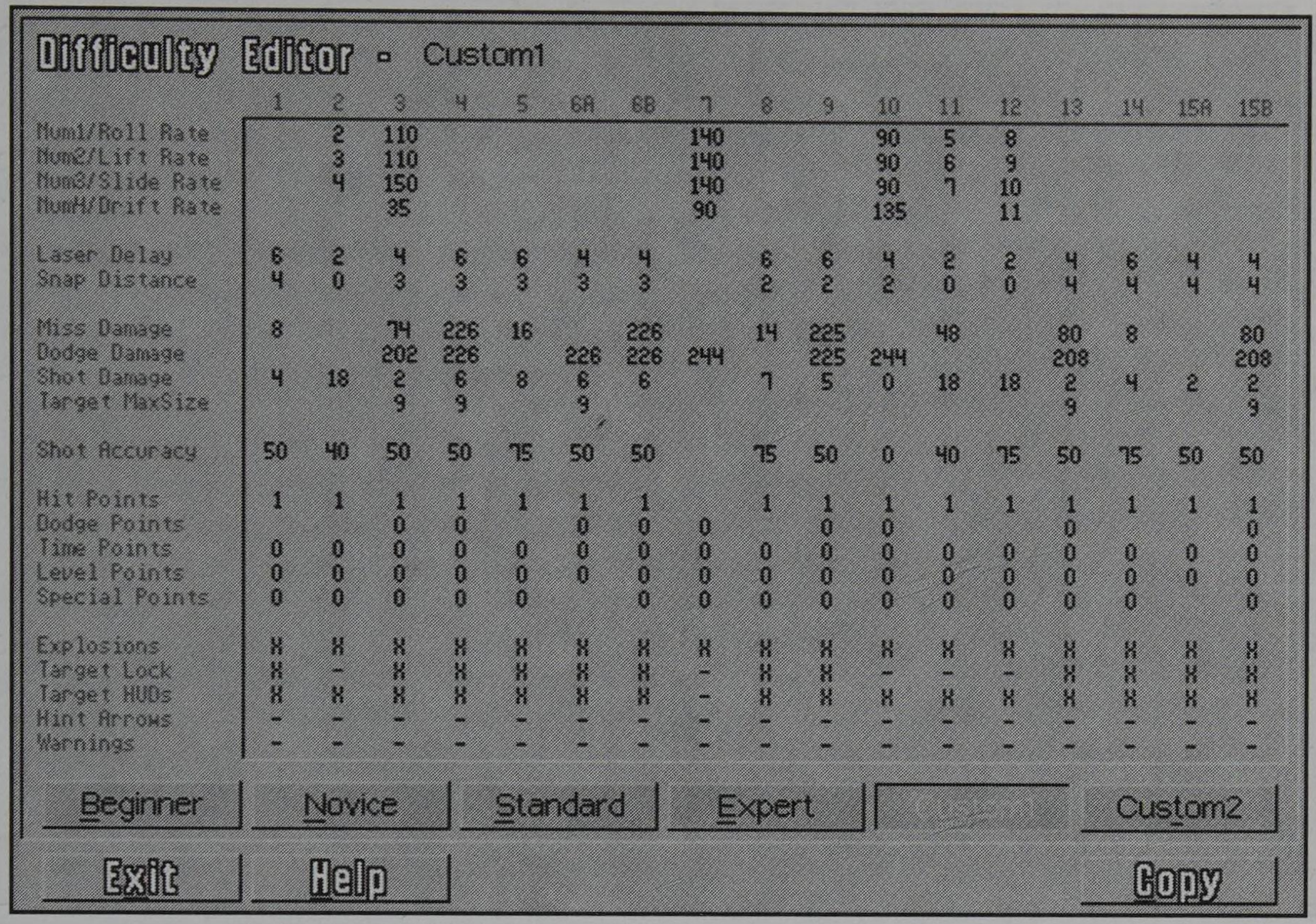
Warnings Whether collision warning messages appear

Warning arrows appear in some levels in *Rebel Assault II* that show you when to turn. They are like hint arrows but don't tell you which direction to move.

DIFFICULTY SETTINGS OF THE JEDI TESTERS

The action-game veterans of The Pit at LucasArts developed these three interesting, challenging, and fun difficulty settings. They will definitely give you a new perspective on the game. Brad Grantham's configuration, The Realist, is meant to emulate the *Star Wars* universe. Chris Snyder designed his configuration, The Test, to be the Standard setting, but this die-hard gamer's idea of the norm was deemed too tough. See if you agree. Matthew Azeveda's configuration, The Ultimate Challenge, is for those of you who can fly with the best and shoot down the rest. Each configuration is followed by the creator's rationale for their settings.





The Realist is based on* Star Wars *research.

The Realist

These are some settings to give the game a sense of "realism." What I did, using some official *Star Wars* source materials, is change some settings to match the type of vehicle or surrounding you're currently in. If it's not fun, at least it's something to toy with.

I varied the handling on some levels. A speeder bike is more maneuverable than a freighter.

I also adjusted the laser delays according to space vs. combat and kept them consistent throughout the game.

I modified the snap distance according to the fire-control systems of different ships. Notice that the personal combat stages have a snap distance of 0. No computer aid here, buddy — it's all you.

I adjusted the damage for a more dangerously real feel. I took into account the different hull and shield ratings and looked at the game with an honest eye. Fact: If you hit a large rock in space at the speeds most small ships fly, I don't care how far they've developed metallic alloys or construction methods, you're going to be in a world of hurt. These things don't have great shields. TIEs don't even have shields. Admiral Krane's warning told you that.

I changed the shot accuracy a little because automated guns probably won't be as tricky as TIE interceptor pilots.

I took out all points. Life is not a point game. I did, however, leave one point per hit so you can brag about how many kills you earned in one game. This also means no extra lives — but you don't need them, right?

The only unrealistic thing I left in was the crosshairs on the personal combat stages. However, since you're not holding the gun, I thought it an unfair handicap to take them out.

Good luck, and as usual, may the Force be with you.

— Brad Grantham

Difficulty Editor ▫ Custom1

	1	2	3	4	5	6A	6B	7	8	9	10	11	12	13	14	15A	15B
Num1/Roll Rate		5	112					110			110	10	5				
Num2/Lift Rate		5	112					110			112	6	6				
Num3/Slide Rate		6	160					110			112	7	7				
NumA/Drift Rate			50					75			75		8				
Laser Delay	5	4	7	7	5	6	6		5	5	7	4	4	2	6	3	2
Snap Distance	1	1	1	1	1	1	1		2	1	1	1	0	6	0	1	1
Miss Damage	30		29	40	20	25	200		15	20	20	10		50	23		50
Dodge Damage			45	55		45	60	40		40	40			40			20
Shot Damage	18	5	16	50	4	30	50		2	10	10	5	12	8	3	8	2
Target MaxSize																	
Shot Accuracy	90	40	80	100	77	80	80		75	75	75	50	75	75	75	75	45
Hit Points	100	100	100	100	100	100	100		100	100	100	100	100	100	100	100	100
Dodge Points			100	100		100	100			100	100			100			100
Time Points	5	0	5	5	5	5	5	5	5	5	5	0	5	5	5	5	5
Level Points	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
Special Points	500	500	500	500	500		500	500	500	500	500	500	500	500	500		500
Explosions	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Target Lock	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Target HUDs	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hint Arrows	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Warnings	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Beginner | Novice | Standard | Expert | | Custom2

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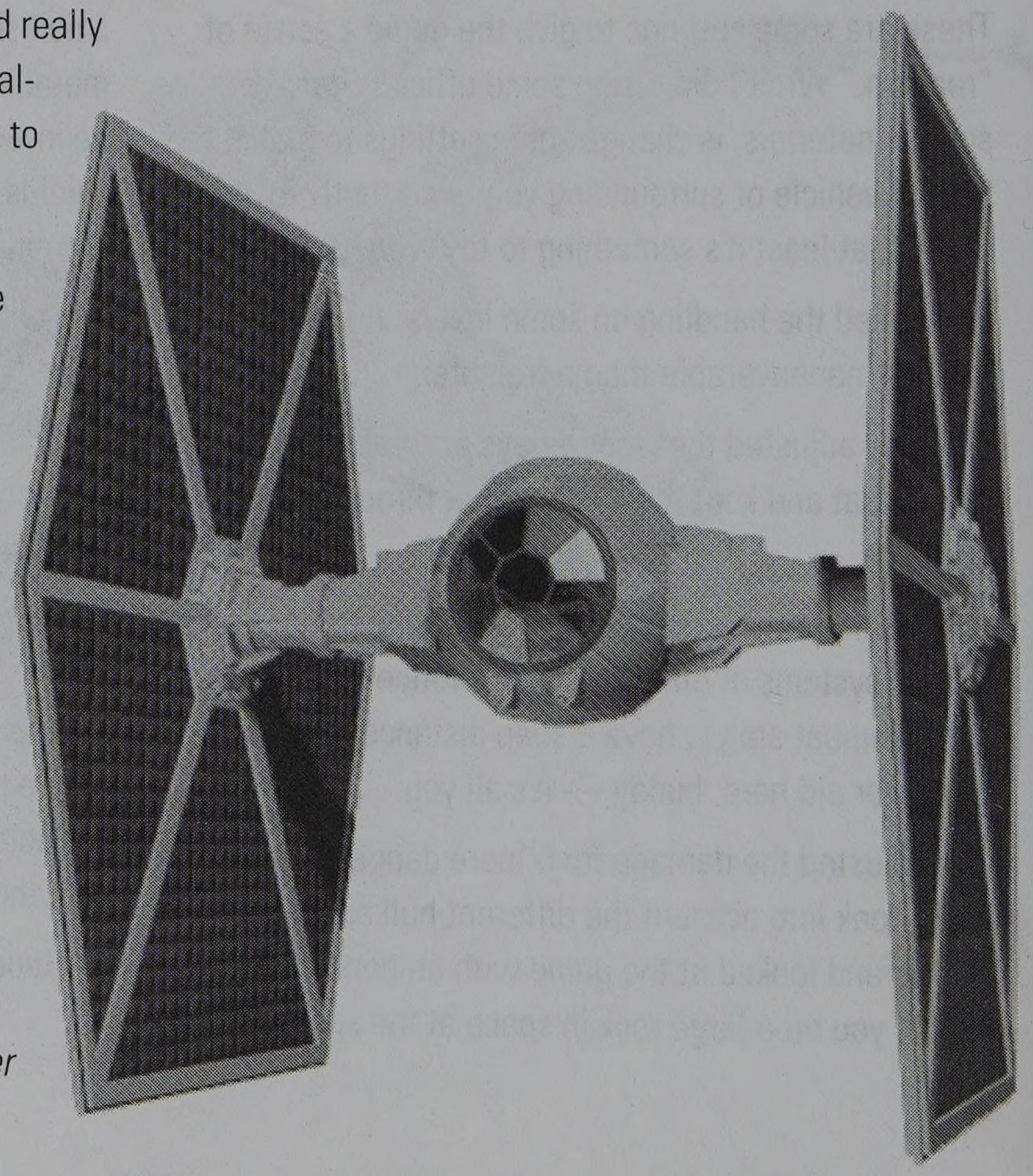
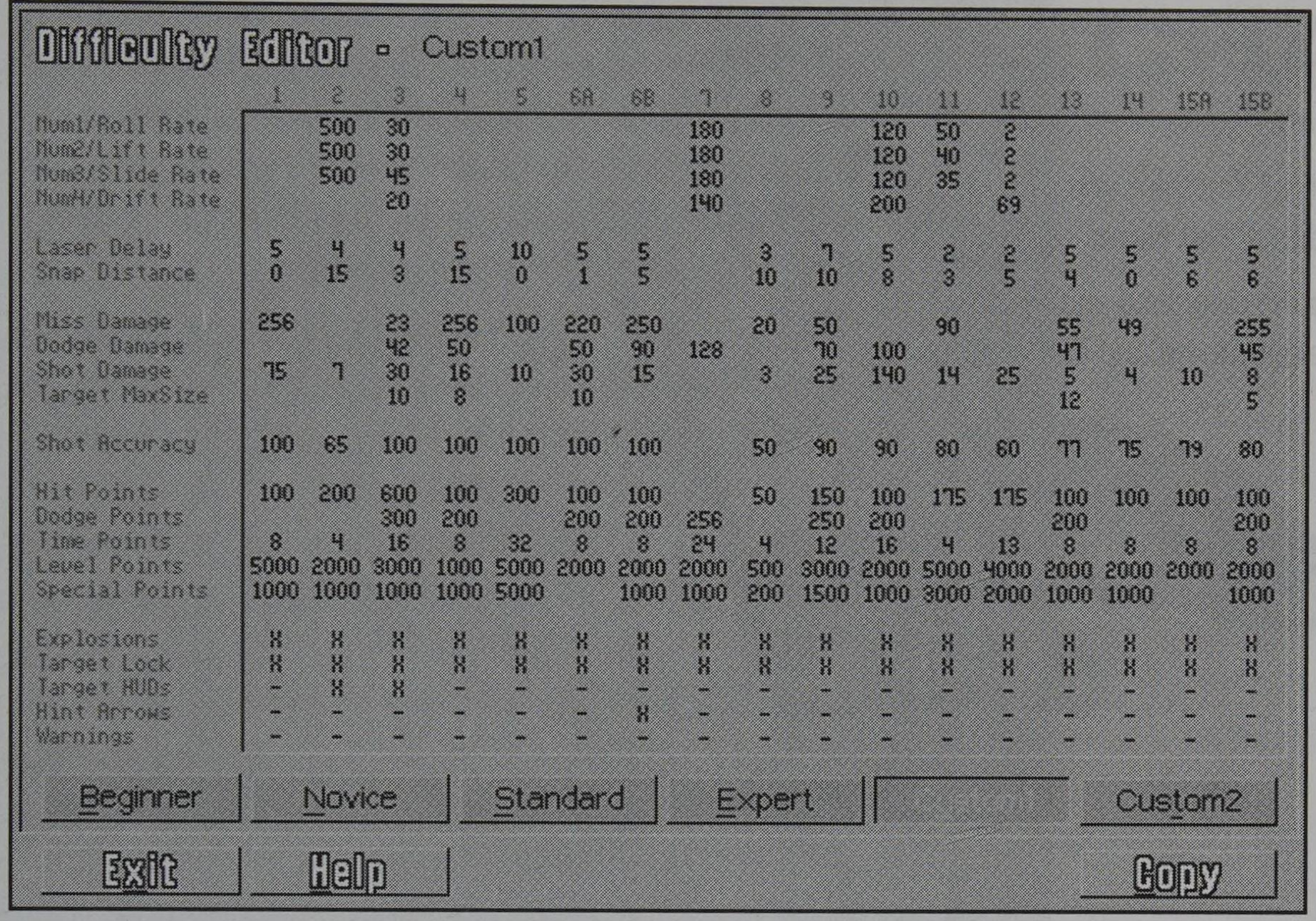
This was going to be the Standard setting. See if you can pass The Test.

The Test

I worked on this setting for about two weeks and really tried to achieve a balance between difficulty, challenge, and fun. I wanted the game to be difficult to the point where under most circumstances, you would just barely make it through a level by the skin of your teeth, and even then you might have to try a few times before you get the level down. I made weapons more effective, giving you more of a fighting chance against the withering volleys of laser fire emitted from incoming TIEs and pinpoint accuracy of the Imperial stormtroopers. I also took out all the target HUDs and target lock-on indicators. It makes these levels quite challenging. For the most part, I left the accuracy of enemy weapons unchanged, or in some cases increased it. I didn't want your weapons to be more effective than your enemies' because where would the challenge be?

— Chris Snyder





Only real Jedis need apply.

The Ultimate Challenge

The Expert settings were used for reference. We've constructed a balance between skillful flying and sharp-shooting fighting. Then again, we can all succumb to the dark side after being in "crunch mode" for so long. Here's a chapter-by-chapter breakdown:

Chapter 1: TIE fighter flight patterns are really easy to predict or track. Kill or be killed.

Chapter 2: When you crash-land on a strange planet under Imperial guard, expect a lot — I said a lot! — of resistance. There's an insane amount of troopers, but they're easy to take out. Be quick, though, or else. You'll be awarded with more than you can imagine. Note: It is strongly advised that you rest your arm and hand every so often when playing this crazy level. Before long, you'll be seeing little white armored guys in your sleep.

Chapter 3: Don't get a false sense of security. A big ship shouldn't be too hard to control.

Chapter 4: Mines have one purpose: to destroy on first pass. So shoot the mines. They're there for a reason.

Chapter 5: Hey! They're TIE interceptors. Good luck. You get major rewards, though.

Chapter 6: Fly, shoot, kill. Fly, shoot, kill. Asteroids aren't papier-mâché. Hit 'em and you're a goner. Hint arrows are included.

Chapter 7: TIEs have no shields. Ahhhh! So fly safely — don't drink goolak before you fly. Now you'll learn how the TIE fighter pilots felt when chasing the *Falcon* in *The Empire Strikes Back.*

Chapter 8: You thought going against TIE interceptors in an X-wing was hard, wait til you fly in a Y-wing. Don't worry, it's a breeze. But then again, you're only a rookie.

Chapter 9: Better use the Force. If you knock out several turrets at a time, I guess it's working. They're

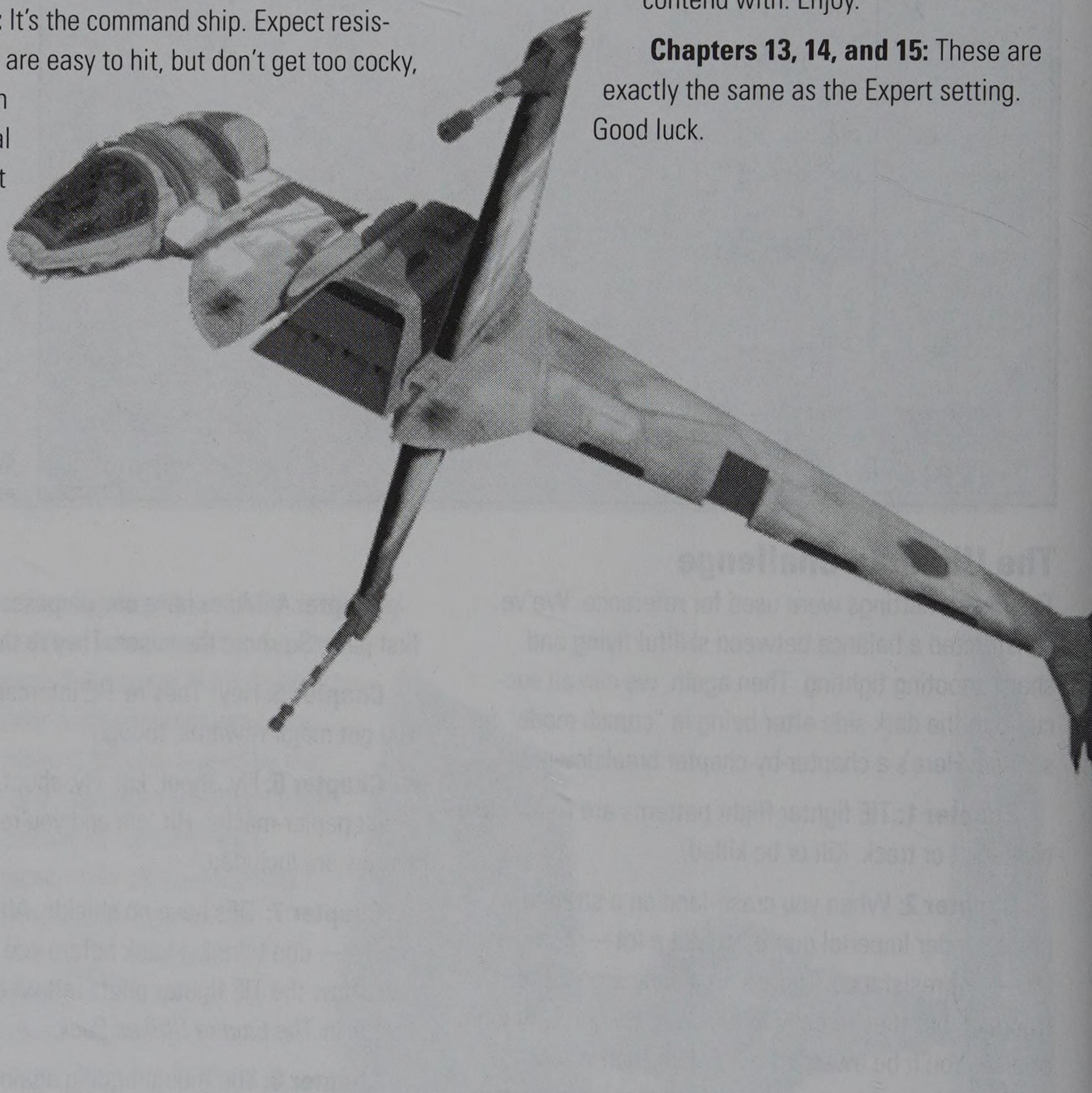
easy to destroy. You'll have a blast when approaching the second shield. Fire on it as soon as possible. It'll be like the Fourth of July.

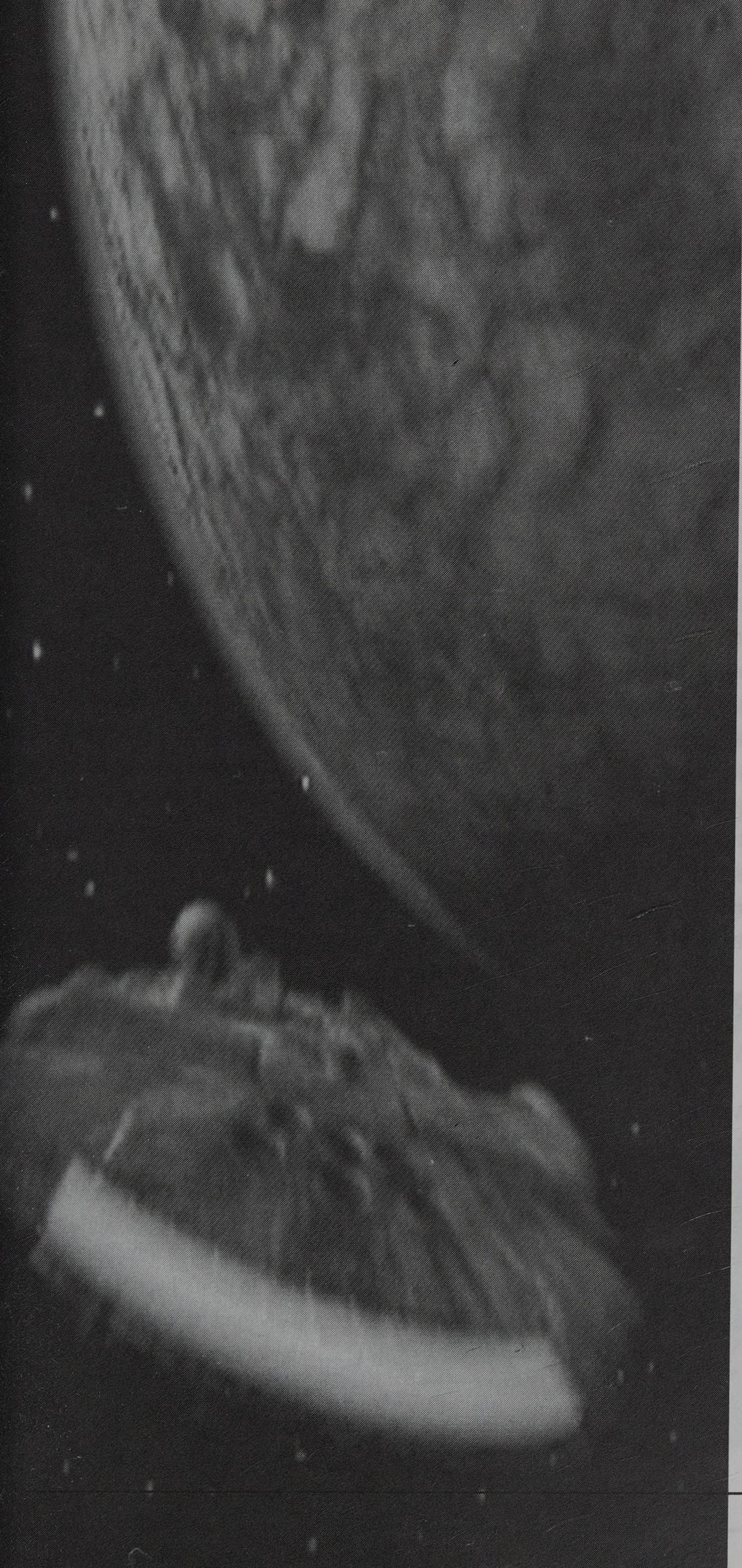
Chapter 10: What? You think you can hit a tree on a speeder bike...and live? Ha! Never.

Chapter 11: It's the command ship. Expect resistance. Troopers are easy to hit, but don't get too cocky, especially when Imperial thermal detonators start raining down on you.

Chapter 12: Who wants to spend time carbon-scoring a sewer? Don't expect much Imperial resistance down here. They're not that insulated in those uniforms. Don't expect them to let you walk through their back door so easily, though. The last stage has many to contend with. Enjoy.

Chapters 13, 14, and 15: These are exactly the same as the Expert setting. Good luck.





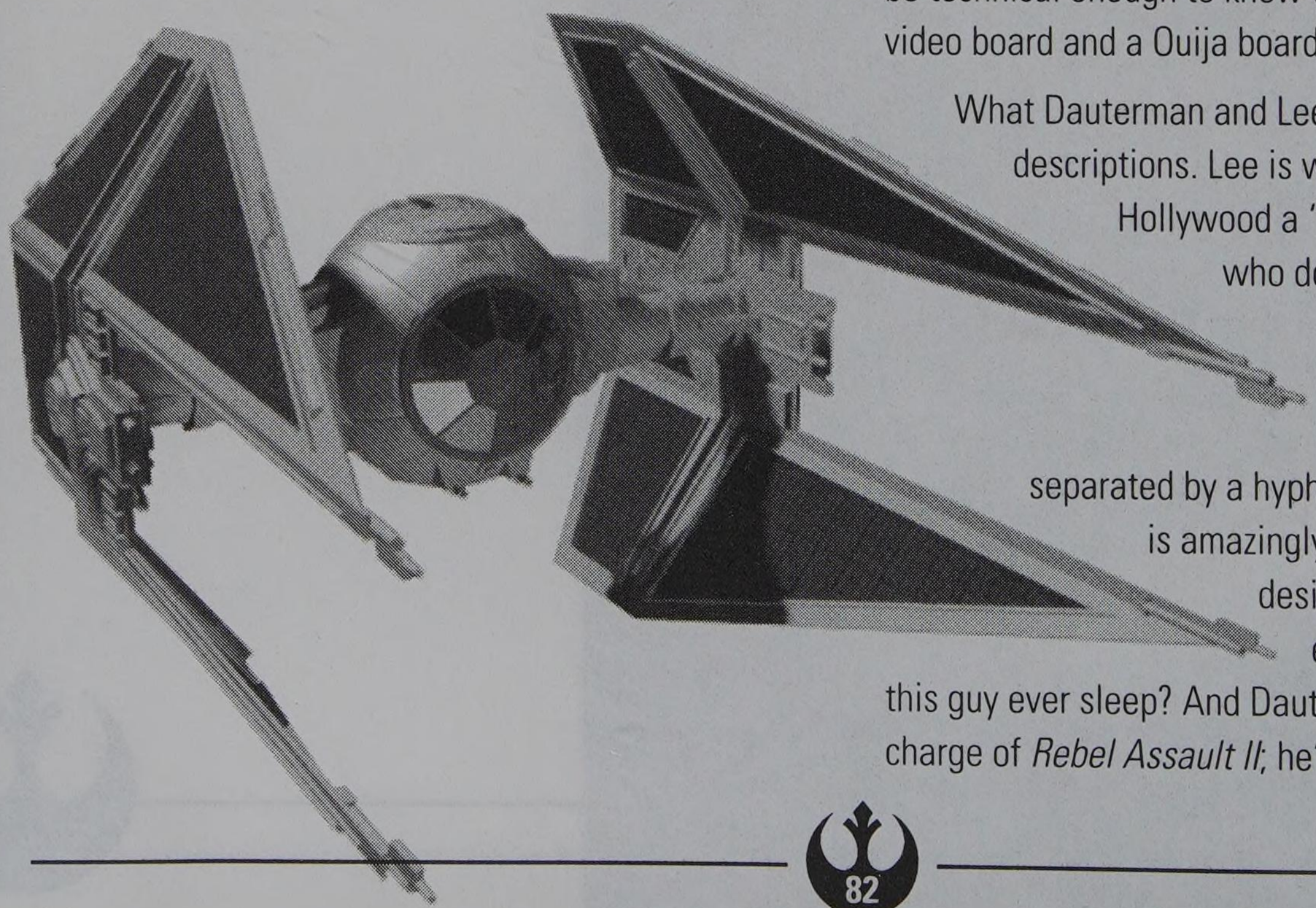
CHAPTER 4

SETTING THE STAGE

Setting the Stage

Rebel Assault II Executive Producer Steve Dauterman and Project Leader/Designer Vince Lee were the driving forces behind the game, and they're know-it-alls. They know technology, they know story development, they know graphics and video, and they certainly know good gameplay. But these well-spoken fellows don't flaunt their knowledge in that annoying, smarter-than-thou way, they just use it to create incredible games. This chapter serves as an overview of how Rebel II was created and introduces many of the concepts and processes that later chapters explore in-depth.

Lee and Dauterman fit traditional definitions of their job titles pretty well as long as you say Lee is a game designer on steroids or Dauterman is an executive producer on steroids. A computer game designer, something like a screenwriter/director on a movie in that he usually has the last creative word, used to be by definition a computer programmer. Nowadays many are more artist (of various ilks) than programmer. The best are both artistic and technical. An executive producer for a computer game is akin to an executive producer on a movie, ultimately responsible for everything that happens on a project, good or bad. He watches budgets, hires people, coaxes approvals from the money people, starts fires when the development team need inspiration, and puts them out when the development team needs relief. He has to be creative and administrative and a good salesman. And for computer games, an executive producer has to be a "gamer" (someone who truly loves computer games — if not, the other gamers on the team can smell his fraudulence a mile away) and be technical enough to know the difference between a video board and a Ouija board.



What Dauterman and Lee do is expand their job descriptions. Lee is what they call in Hollywood a "hyphenate" — someone who does several major jobs on a movie (like director-screenwriter), the names of which are separated by a hyphen. Lee's hyphenated list is amazingly long: storyboard artist-designer-writer-programmer-editor-music editor. Does this guy ever sleep? And Dauterman is not just in charge of *Rebel Assault II*; he's ultimately responsible

for every project that LucasArts currently has under development.

When I spoke to them in August 1995, LucasArts had just moved into new headquarters in San Rafael, California, several miles north of their old headquarters and about 20 miles north of San Francisco and the Golden Gate Bridge. The ever-expanding game group had been busting seams of three buildings in their old San Rafael digs. The new HQ puts LucasArts just a few winding-country-road curves from George Lucas at the *Star Wars*-making Skywalker Ranch (and the Pacific Ocean) It also marks the first time that the entire company has been under a single roof — and what a roof! LucasArts gutted a single-level building that used to house more conventional offices and transformed it into a 3D version of *Wired* magazine — bright and colorful, full of incongruous, high-tech textures, virtually impossible to find your way around in, but fun. People were joking about the aerobic high they were getting walking from one end of the place to the other. The "nonbusiness" employees — for the most part 20-something boys-to-men dressed in T-shirts, jeans, and tennis shoes or Birkenstocks — were just starting to fill the vast space with hip, idiosyncratic "stuff." Week by week the interior evolved and began looking less and less like a former life insurance office and more and more like an artist's bad dream or a techno-geek's bachelor pad.

Most of the group dwells in square cubicles with carpeted walls. But we met in Vince Lee's office. It might have been a good-sized office, but the ring of computer systems that circled the room made the space feel small. And this was only his first week, before the natural clutter of time would surely drift in and settle like dust. On the other hand, Vince Lee is spectacularly organized. Maybe that's why they gave him an office instead of a sofa in the bachelor pad.

The marker board on his wall featured a crammed (and incomprehensible) schedule for the completion of *Rebel Assault II* that looked like it was written by someone who actually does what he says he will do. When I asked him for documentary information, he quickly pulled out one of many black folders and showed me whatever I needed. Most noticeably, however, when Dauterman stammered about the "real" release date for *Rebel II* — as all good executive producers must do because of the universal law of software "slippage" — Lee stepped in like a fullback demanding the football and said the game would definitely be finished on time. The executive producer looked at me, but his glance wasn't the least bit skeptical. *Rebel II* was pushing the envelope in almost every phase of game design, and "the unknown" usually blasts the hell out of release schedules. But both of these guys had weathered this process before on the original *Rebel Assault*, and both thought they were much more prepared this time around. *Rebel Assault* was a good game that became a megahit. This time they wanted a megahit that was also a great game in every way. To find out how they accomplished that goal, you have to dig back into the roots of *Rebel I*, back when the project was tentatively titled *Star Wars CD* and no one was that crazy about doing it.

BACK TO THE BEGINNING

The original *Rebel Assault* came out at Christmas 1993 after a year and a half of development. How did the concept for that game come about?

Vince: The original concept was from JVC. They wanted to do something

REBEL BRIEFING

LucasArts had a contract with JVC to develop games that the Japanese electronics company would then publish. *X-Wing* is another space combat game from LucasArts.

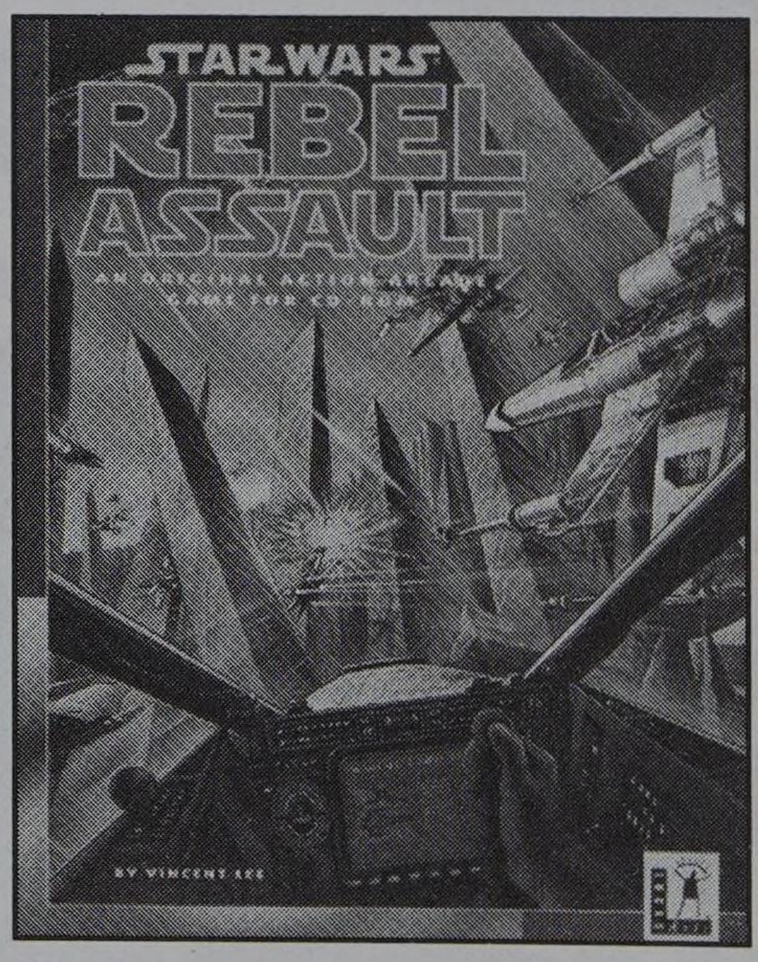
REBEL BRIEFING

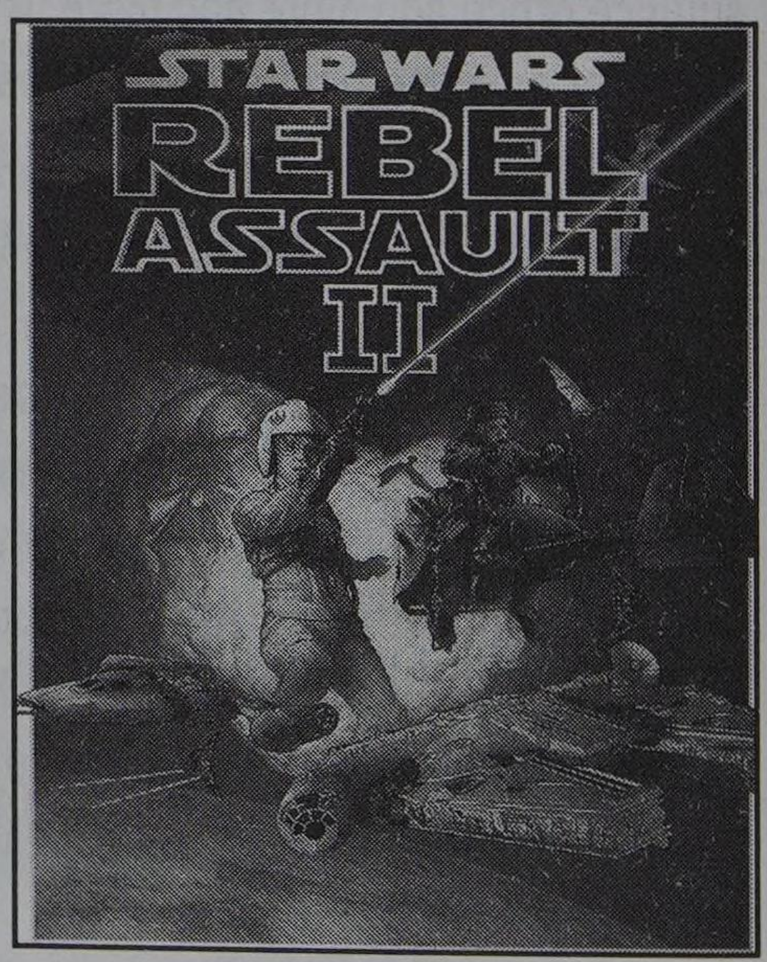
"Streaming video" is a sexy name to describe a faster way to read and replay video from a CD-ROM disk so that the action you see appears constant. Three-dimensional (3D) animation means creating movielike sequences on computers with software animation tools like 3D Studio. The computer artist draws images and animates them entirely on a computer. It's unlike traditional animation, which takes physical drawings called "cels" and films them with a camera. Two-dimensional (2D) animation looks more like a moving comic book and doesn't have the depth and realism of what you see in movies and recent computer games.

like *X-Wing* but with land sequences as well.

Steve: We wanted to do a CD product, and this was at a time when the Sega CD had been announced and there were a couple other CD machines out there — it appeared that CD was going to be the next big thing. The idea with our property was to do a *Star Wars*-based game. JVC left it to us to design and said, "We want *Star Wars* on CD." We really didn't know what that meant. It was Vince who came up with the idea of using the CD to do streaming video. The code name was simply *Star Wars 3D CD.* We didn't know it was going to be *Rebel Assault.* It was an experiment for us in developing 3D rendering. At the time, we hadn't gotten into using 3D Studio or other animation software. We were still doing SCUMM graphic adventure games with traditional animation. ["SCUMM" stands for Script Creation Utility for *Maniac Mansion,* the first graphic adventure created by LucasArts. SCUMM is the LucasArts computer program used to create such graphic adventure games as *Loom* and *Indiana Jones.*] It was clear that 3D was going to be the next big thing, and this was our first "in" to getting three or four artists working in 3D Studio. So its genesis was really experimental for us. Now we probably have 25 artists devoted solely to 3D animation.

Vince: All our games now — *Dark Forces, TIE Fighter, X-Wing, Full Throttle* — have 3D elements meshed in with traditional 2D animation. But *Rebel Assault* is still the only game where 3D animation is used almost exclusively. It was start to finish a 3D-rendered product. It was really the first of its kind that way. In *Rebel Assault II,* we mesh more video in with 3D-rendered backgrounds.





***Rebel Assault was a megahit by any measure. It has sold more than 1.5 million copies worldwide, has been translated into a half dozen languages, and is still selling strong after two years. LucasArts hopes to duplicate the success with* Rebel II.**

Before it was released, did you have high hopes for *Rebel Assault*? Did you know that you had a hit on your hands?

Steve: To be honest, no. It was planned for release in November 1993 without great expectations. At the time, the one thing that I was proud of was that we did it on a very slim budget. So I figured that we were going to make our money back, and maybe actually make some. We were getting some internal momentum behind the game, but not many units of CD-ROM machines — until that Christmas — had been sold.

Vince: I think that halfway through the project, the estimated sales were 25,000 units, and by the release it had jumped to 50,000 units. I was really excited about that. It would have really been considered a hit around here if it did 50,000 units.

Steve: And when Rebel was released, it just so happened it was that Christmas when everyone went out and bought CD-ROMs. It was out there at the right time and the right place. It was the perfect showcase title for CD-ROM because it used the technology the way people are using it now — filling it with great animation and digital-quality music and sound. We didn't know what we were sitting on at the time, but it truly was a breakthrough product. In the first month or so through Christmas, it had already sold 300,000 or 400,000. We also had been fairly aggressive at bundling it with hardware, so it sold a great deal that way as well. One of the things you worry about when you OEM a title is that it will cannibalize your regular retail sales, but it didn't have that effect. In fact, it has sold steadily for nearly two years. It has had incredible longevity. Most products traditionally have about a three-month cycle of sales. But *Rebel* is like *Myst* — they just keep growing and growing. It still sells well.

REBEL BRIEFING

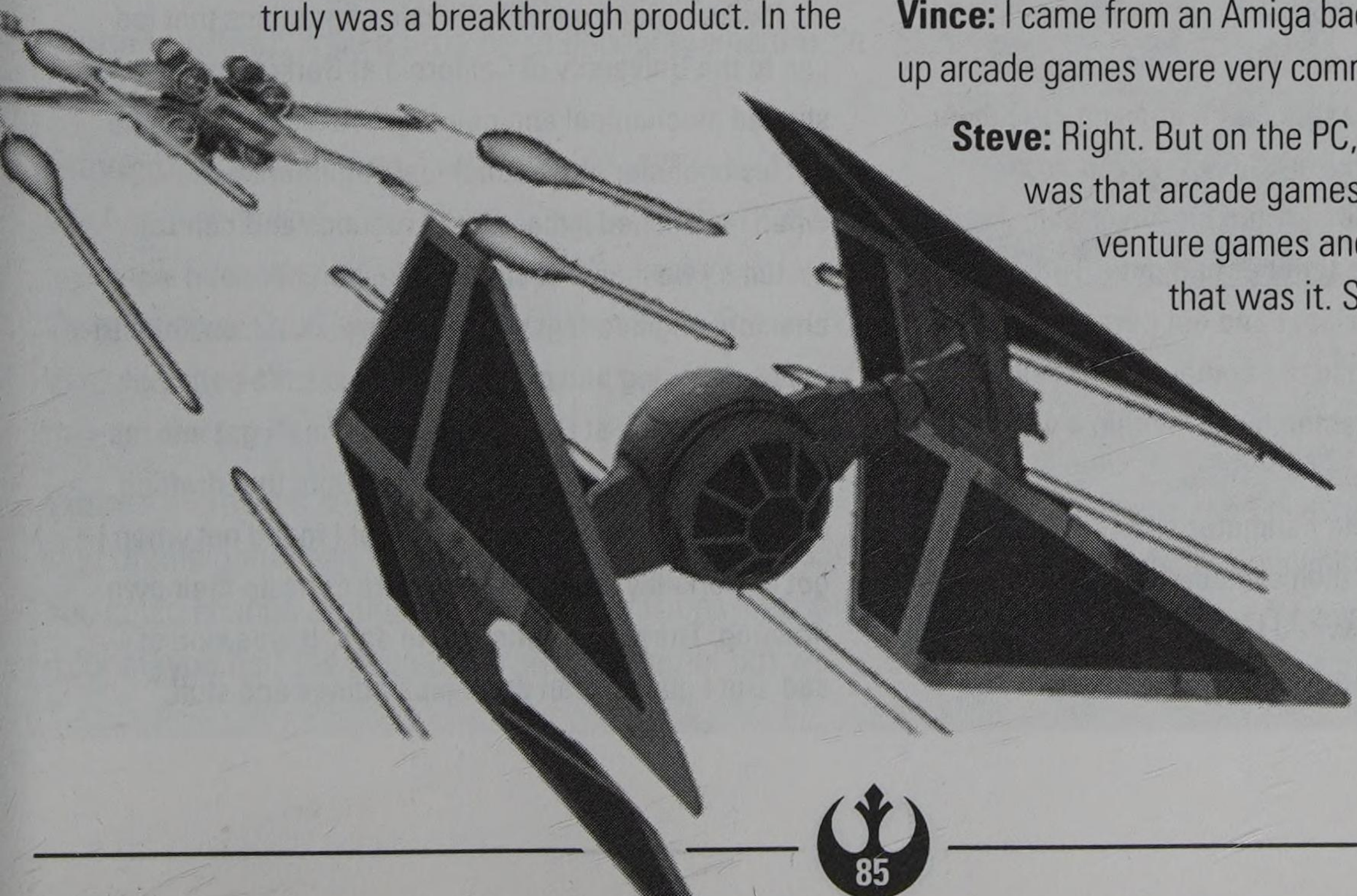
OEM stands for Original Equipment Manufacturer. It's an industry term for computer hardware companies like Apple or Gateway. Software publishers often sell their programs and games to these companies at or below cost to get them bundled in computers. This hands-on approach is perhaps the most effective way to advertise software

Vince: You can't have two games that are more different than *Rebel Assault* and *Myst*. *Rebel* is essentially just a shoot-em-up arcade game.

Steve: Frankly, that was one of the reasons why we weren't sure *Rebel* was going to do very well because, traditionally, arcade shoot-em-up games on the PC hadn't done very well. But the game sort of reinvented the genre for the PC. They had always done well on Nintendo and Sega.

Vince: I came from an Amiga background, and shoot-em-up arcade games were very common on the Amiga, too.

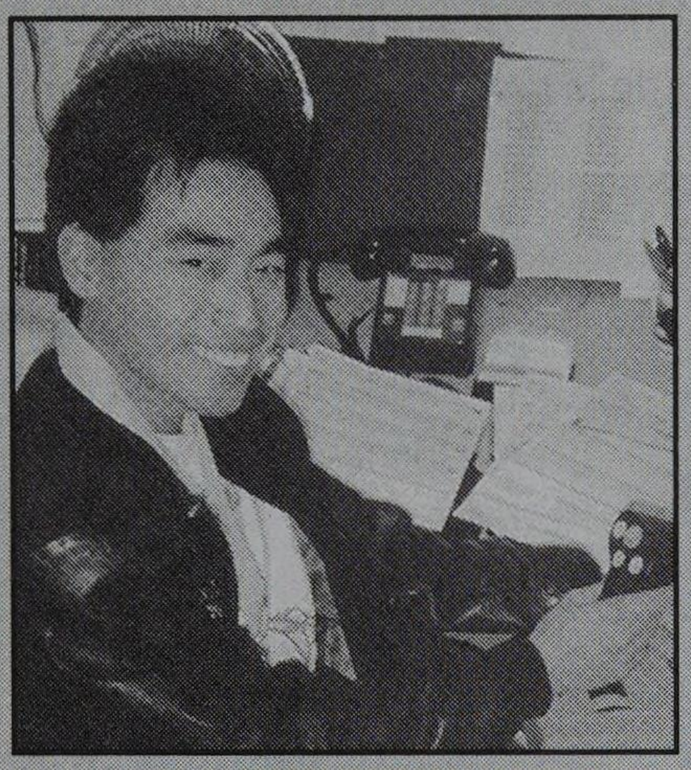
Steve: Right. But on the PC, the common wisdom was that arcade games don't sell. It was adventure games and flight simulators and that was it. Some of the traditional



REBEL PROFILE

VINCE LEE

Project Leader and Designer



Vince Lee, project leader, designer, programmer, and writer

Can you imagine a time when there were no video games? If you can't, it means you're a video game kid. If you can, it means that you're really a television kid (because you can't remember a time when there was no television). Television kids are pushing 40 and beyond now, and even though many of them may love video games and play them often, they can't ever be bonified video game kids. To truly be a video game kid, you had to have learned the technology and the content of video games through osmosis, the way you learned to speak English.

Vince Lee, 27, creator of *Rebel Assault,* is a video game kid through and through. Video games are in his bones and can't get out. He learned the rhythms of electronic games on the fly, growing up in bucolic Concord, California (east of San Francisco). His older brother, who now works in computer graphics for Microsoft, used to take him into his junior high math class late at night. The teacher had put a TRS-80 Level I computer in a closet and encouraged free exploration. "He would use the computer and talk me through things," Lee remembers. "Within a year I was starting to program."

He got his first home computer shortly thereafter, a Heathkit, build-your-own system that his father, a mechanical engineer, wired together. Lee's parents encouraged build-your-own creativity. "We had a very strange household," Lee says. "Our house was filled with all sorts of tools and gadgets. Wall to wall. The garage was full of all kinds of things. I grew up in a house where we there was a cement mixer in the backyard and soldering irons and arc welders on the inside." Lee didn't spend much time with the cement mixer, but he dominated the Heath. What does a video game kid do on his first computer?

"I wrote games," he says. "At first they weren't very graphical, but as quickly as I could get into it, I started doing little graphic games that were emulations of games that were in the arcades at the time. I did a *Space Invaders* and an *Asteroids* and a couple of other similar games. By this time, I was programming in Assembly language, and I sold my first game when I was 16. It was to a Heath users group, sponsored by Heath-Zenith, the company. I sold it for a couple of hundred bucks. It was called *Castle,* and it was a knock-off of the arcade game *Berzerk*. You have a little guy and you walk around from room to room in this castle picking up treasures. It had blocky, text-based graphics — all that my machine was capable of. By the time I had graduated from high school, I actually had gotten kind of bored because the graphic and sound capabilities of computers had not really gone anywhere, and that was what I was primarily interested in."

It was a video game kid's love of graphics that led Lee to the University of California at Berkeley where he studied mechanical engineering. (He was 21 when he got his bachelor's in mechanical engineering and 22 when he finished a master's in robotics and control systems.) He makes a clear distinction between mechanical engineering, which is more visual, and electrical engineering and computer science, the path that his brother took at Berkeley before him. "I got into mechanical engineering because I thought that drafting was cool. Little did I know, but what I found out when I got to Berkeley was that engineers don't do their own drawing. They hire draftsmen to do it. It was kind of sad. But I guess I can draw pipe fittings and stuff."

PC people didn't like *Rebel Assault* at all because of that. They really wanted the traditional flight simulation, more thinking.

With the fast success of *Rebel Assault*, did thoughts of a sequel immediately surface?

Vince: At first, I didn't think about it. It seems an almost obvious thing for a company that has a success to go ahead and do a sequel, but at first I didn't think I could offer anything new. And if I couldn't do anything new, I didn't want to rehash the same territory. The first game covered the *Star Wars* movies. It took the first movie and a little bit of the second, and there weren't really enough elements left in the series that would lend itself to this sort of game. *Rebel Assault* was a pretty straightforward arcade game — I just didn't want to do the same game again with different images. So I wasn't really planning on doing a sequel.

I was spending all my time doing different conversions of *Rebel Assault* — Sega CD, 3DO, Macintosh. And there were a lot of foreign-language conversions keeping me busy. I was also thinking about a couple other new projects and doing some tool work. It wasn't until probably May [1994] that I finally decided to go ahead and do it.

What changed your mind?

Vince [smiles]: I had a little bit of encouragement from management.

Steve: We couldn't deny that *Rebel Assault* was a hit. We had also talked about doing a sequel with Vince less involved. Someone else would head the project using Vince's engine, and Vince would consult on it. But then Vince decided that he had enough of a new idea here to take on the project himself.

Vince: There was some talk at first about doing some kind of minigame and having it done by the end of 1994. You could change around some of the missions and sell it for maybe half the price of an original game. But we

REBEL PROFILE

VINCE LEE
Project Leader (continued)

But video game kids never stray too far from games. At the end of his freshman year, Lee had saved enough money to upgrade the technology for his programming habit. "I had gone to the West Coast Computer Faire," he recalls, "and I was flipping through an *Amiga World* magazine that I had picked up for free. And lo and behold, there was this advertisement and articles about this new Amiga computer that was coming that had, you know, an impressive 32 colors, and not just EGA colors, but 32 colors you could actually change. And four-channel sound. The possibilities seemed really stunning, and I went out three days later and just bought one. It was great. It was amazing. Especially compared to what I had used before — black-and-white character graphics."

So in his spare time, Lee wrote games. Arcade games with real graphics and four-channel sound. His favorite was called *Stellaryx,* an *Asteroids* clone with fancier graphics and a few twists. Unlike many games created in the late 80s, its gameplay was better than its marketing. But that might not be saying much.

Stellaryx, Lee's first color game

"I think it had the record for the ugliest packaging ever created for a computer product," Lee says. "A friend of mine packaged and sold a bunch of them, giving away most of them to friends at computer stores in the Amiga community. His sister did the artwork. There's this one computer store that still has boxes of them that they give away free at trade

all agreed that wasn't the way to go. You would still be doing most of the effort of doing a full game in order to come up with something two-thirds as long. But by that time I had developed quite a bit of new technology — I had been working on the *Rebel* engine all along — and I realized that I could offer something new. The gameplay could be a bit different and the graphics could be spectacular. And we thought we could really do as much video as possible. That's when I really started to get enthusiastic about the project.

Steve: Plus, having a new, original story to tell helped. Rather than rehashing the *Star Wars* movie, we'd have an original story to tell in addition to the new technology. In good games, something has to be new. In *Rebel I*, it was 3D animation. For *Rebel II*, it would be our first big jump into video.

Once you committed to making a new game, what was the overall goal of your design?

Vince: I just wanted to do everything the first game did, but better. Better image quality, better gameplay, better controllability, better sound, better story. I really wanted to top it in all respects. And I think we have.

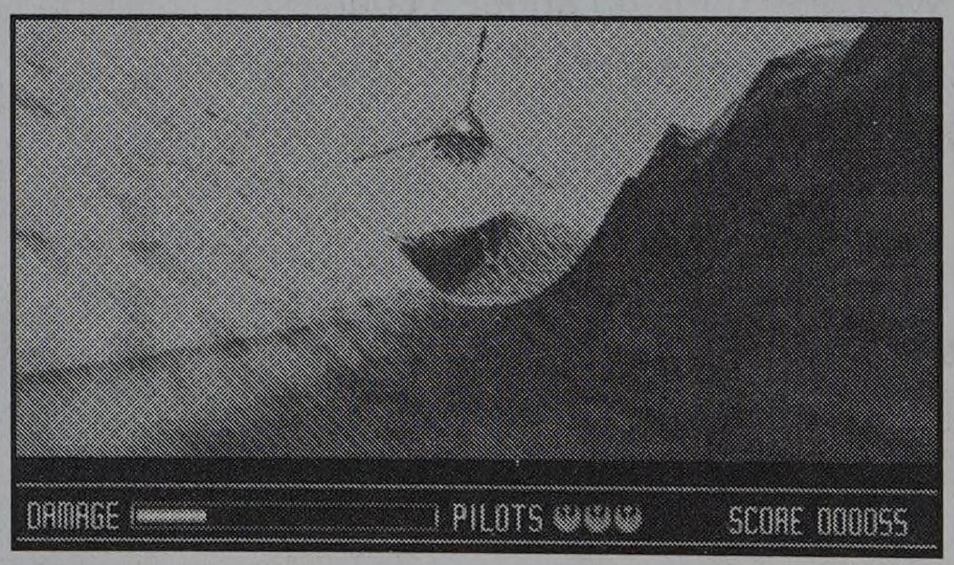
INSANE TECHNOLOGY

How would you describe the new technology that's used in *Rebel Assault II*?

Vince: It's all-new technology across the board. The sound system has gone through extensive changes. Instead of just a four-channel mono sound that was in the first game, it's now actually 10 sound channels and stereo. It really takes advantage of your sound card if you have a 16-bit sound card. On the visual side, the image-compression technology has dramatically improved. So instead of having the old, ugly, clunky kind of compression which limited us to just 16-color backgrounds, now it's full 256, high-detailed, full-screen color, which is good enough to actually handle video.

The engine you created for *Rebel I*, called INSANE (Interactive Streaming Animation Engine), worked very well. Did you just add the video capability to INSANE or was it a complete retooling?

Vince: The structure of it has entirely changed. It won't be apparent to anyone on the outside, but the new structure allows all the changes and improvements in the game. The sound is better because the sound engine has been rewritten. The video is better because good compression algorithms have been added to the engine. The engine is really just a name for the core of the program. But it's easy to refer to it as an engine



***Improved graphics? You bet! The top screen is a training flight in* Rebel I. *The bottom screen is the same from* Rebel II.**

because the way I have structured it makes it very easy to pop out and use for another game. It's kind of encapsulated so it's easy to change the periphery so other games could use it for gameplay or cut scenes with new images and sounds.

How do the changes improve the experience for the player?

Vince: Of course everything looks better, higher quality. But also a lot of animation limitations have been removed. In the first game, the levels had to be very carefully designed to use only a certain number of colors, have objects look only a certain way and only do certain things. The newer compression allows us and the animators much more freedom to create much more complex objects. Now you can fly inside bases with all sorts of complex architecture.

Can you give an example?

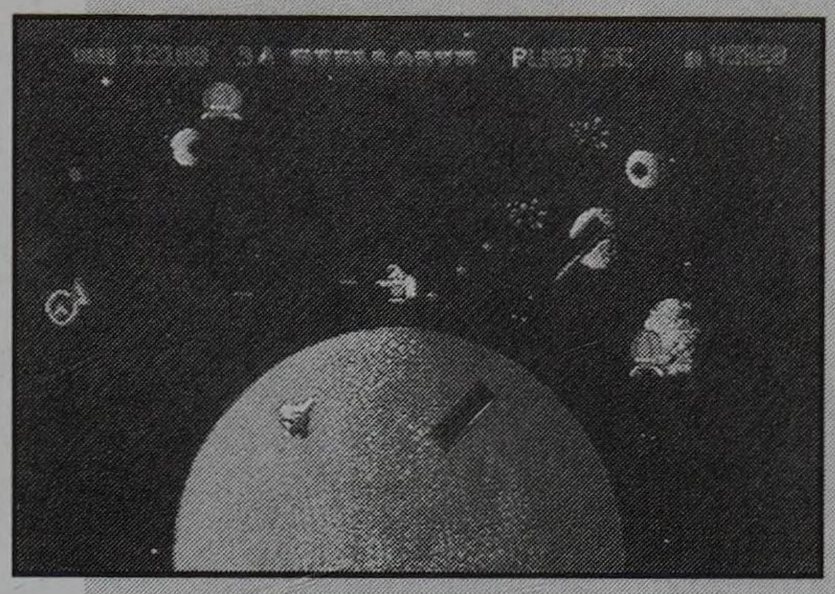
Vince: In *Rebel I*, you often had to fly through a monochromatic, gritty kind of trench. Or, like in Beggar's Canyon, you're maneuvering through a basic brown corridor. Very simple imagery, not a lot of colors, very large, simple details — right wall, left wall, door. You couldn't see much detail. There was no complex machinery with struts or anything like that. Whereas in the new game, when you get to fly inside a base, there's everything. You have windows, guns, complex textures, hard edges — something the old compression didn't do very well. And instead of just flying around on the outside of most surfaces, you do a lot more flying inside and around, which really heightens the realism.

What's the secret of your faster video compression?

Vince: It's just a smarter algorithm. It's one of those things that's very common in the industry right now — everyone is scrambling for faster compression. The raw data that needs to be pulled off the CD so that you can

REBEL PROFILE

VINCE LEE
Project Leader (continued)



A screen from Stellaryx

shows. Most people who have seen it tell me the game is pretty good. I give people here at work free copies, but I tell them to look at the screen shots on the back, not the front, which is just horrible."

It's a big jump from home-baked arcade games and Amiga trade shows to LucasArts, even for a video game kid with a robotics background. How did Lee make it? "When I was at Berkeley, I had met a producer from Lucas and had showed him some of the stuff that I had been programming on the side," Lee says. "I don't know how impressed he was or whether he was just trying to play Mr. Bigshot, but he asked me to give him a call. After I graduated, I was looking for a job, and I was invited to have lunch at the Ranch with a friend. I had a number of friends who were working here. I remembered what the guy said, so I gave him my resume and said, 'Here.' I was hired [in March 1991] into the tools group and started porting SCUMM games to the Amiga."

And then came The Big Break. After only a year, Lee was assigned to head up the *Rebel Assault* project. Surely this came about because of a clear recognition of Lee's video game kid genius. Why else would they pick a rookie to design the first CD-ROM game to sell a million units? Vince laughs. "Because nobody cared about it. If someone had, it probably wouldn't have happened."

Executive Producer Steve Dauterman explains the exhaustive selection process. "We had this

REBEL PROFILE
VINCE LEE
Project Leader (continued)

multiproduct development deal with JVC, and one of these was to do a *Star Wars* game on CD. And we had to get it done pretty fast and we had to find someone who would do it, and it was, "Hey, Vince, you want to try it?"

The rest is history. Both Lee and the video game business have grown up. Hollywood is throwing its big money around, game budgets are rising, marketing costs are soaring, and game companies aren't walking around asking just anybody if they want to try it. Lee is now a video game man (with a video game kid still inextricably lurking in his bones) heading a 30-person project that is once again cutting new ground in entertainment art and technology. He has a house a few miles down the highway from work, he still has his Amiga (which he never touches), and he plays ice hockey when he wants to "diversify" his activities — although he's skating less since he broke his leg. As he describes it, he was "hot-dogging on the ski slopes" and went over a blind jump into a tree pit. At least he missed the tree.

Lee sure doesn't miss much in the computer world. He knows that the secret to his success is the "build-your-own" mentality that was fostered by his parents and jump-started by his brother with a TRS-80 inside of a math room closet. "I have a firm grip on the technology," he says. "You need to know what your design constraints are. And since I myself am the programmer here on this project as well as the designer, I think it gives me an edge in that I can design up to the constraints. I know what the machine is and is not capable of, and I can tailor my design to best take advantage of the machine."

And what does he do if he wants to pull something off that the machine simply won't allow him to do? Like any true video game kid, he doesn't take no for an answer. He pushes the replay button and figures out a way to blast his way through. "You can always find something that works," he said.

animate images can't be pulled off the CD fast enough — you can barely pull it off the hard drive fast enough. When you compress the video, however, you can. That's why everyone from Intel with their Indeo compression to Apple with QuickTime is trying to find some way to compress video so you can pull it off a CD and animate it. There's two parts to the process. The toughest part, after coming up with the algorithms, is taking the raw imagery that you get from video after it has been processed and composited, then breaking it down, analyzing it, to find a way to compress it onto the CD so that it can then be decompressed and animated in the fastest possible way.

REBEL BRIEFING

Within a week after this conversation, the decision was made to put the new game on two disks.

Steve: Fortunately, we have the luxury of designing *Rebel II* for a much more powerful machine. The minimum machine we targeted for *Rebel I* was a 386 computer with a single-speed CD-ROM. It actually ran very, very well on that system — which I think was one of the reasons for its success. Unlike many other games that came out at that time, *Rebel* didn't require more machine than people had. Now our goal is to have *Rebel II* working well on a 486, 50MHz computer with a double-speed CD-ROM drive, which is really a low-end kind of machine these days. Just having that horsepower is a big plus. And Vince has done some things to make it scalable for use on Pentium and faster machines as well.

Rebel Assault came on one disk. Will the sequel be on one or two?

Steve: The idea is to have it on one. It would be tough to break it up.

Vince: We're going to be right at the edge of having only one CD. Running a CD at double speed is only 37

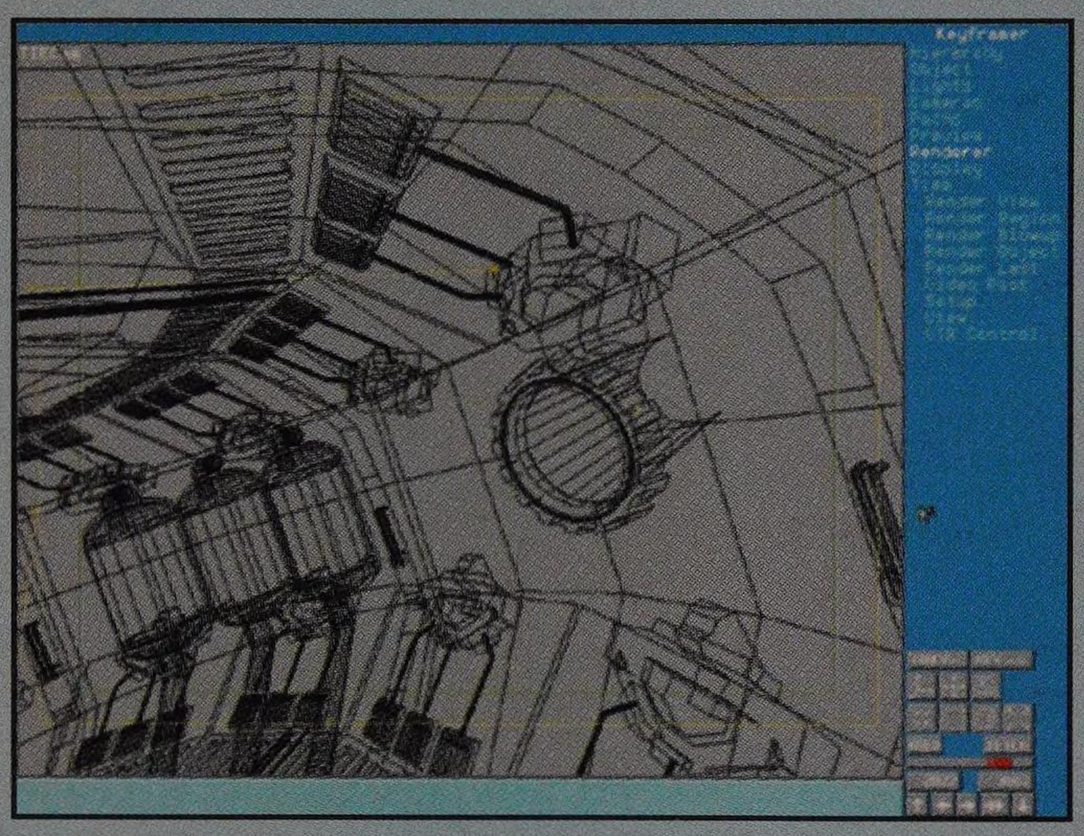
THE ART OF *REBEL ASSAULT II*

The LucasArts artists are without question one of the most talented group of individuals assembled anywhere. While some might feel constrained by the legacy of Star Wars, *these craftsmen seem inspired by it. They expand the breadth and depth of that legacy by creating incredibly realistic environments that remain true to the* Star Wars *universe.*

For Chapter 13, Lead Artist Richard Green and 3D Animator Daniel Colon Jr. brainstormed ideas for the space station. "Richard would give me a lot of verbal descriptions," Colon said, "sometimes referring to photos or sections of *Star Wars* movies. He would do a rough sketch for me, which was very helpful. They not only carried on established guidelines, but they also allowed me to fill in the detail with my own interpretation of the style of *Star Wars.*"

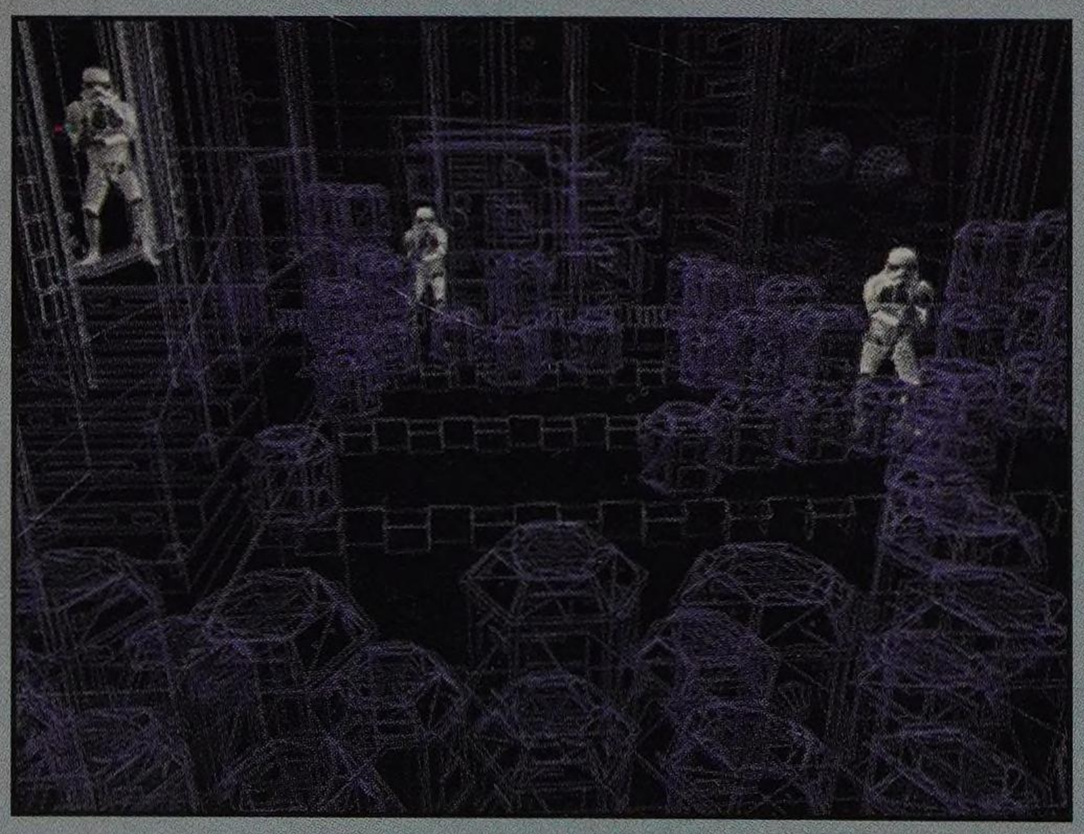
Attention to detail can be time consuming, however. Chapter 13 has more than 2,300 frames like the one below. Colon joked that he worked on it so long he was being referred to as Dan "Level 13" Colon.

"I had to divide all of the 3D geometry and animation into five different pieces and render each section separately," he said. "And there is a section that loops. The second hangar section took more than an hour per frame to render."

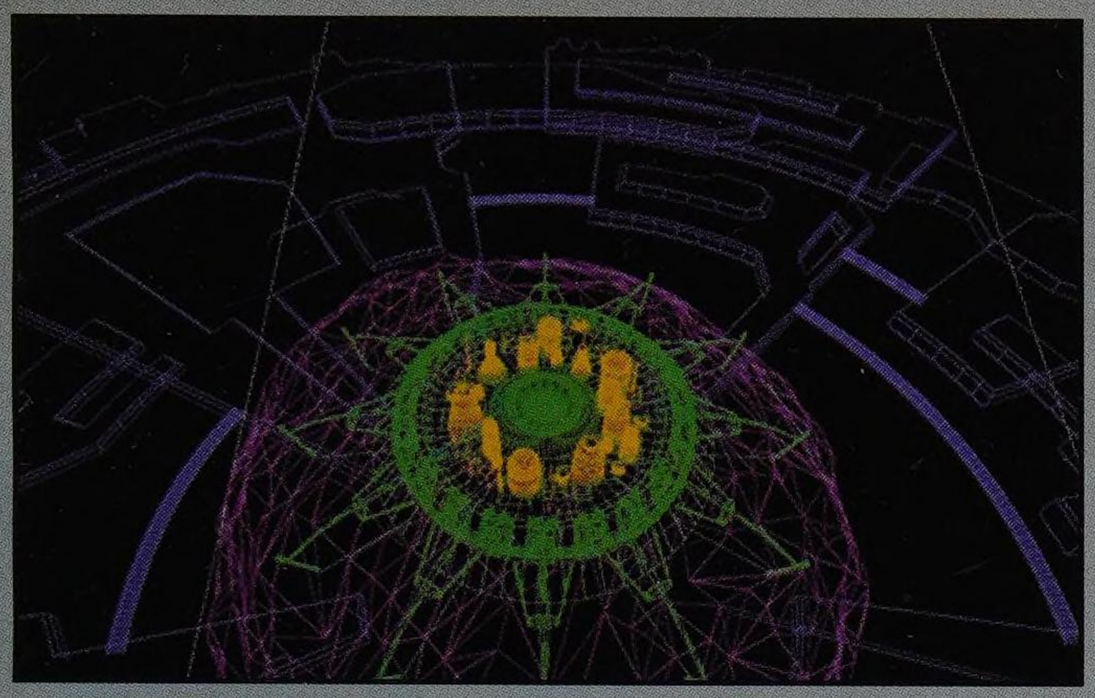


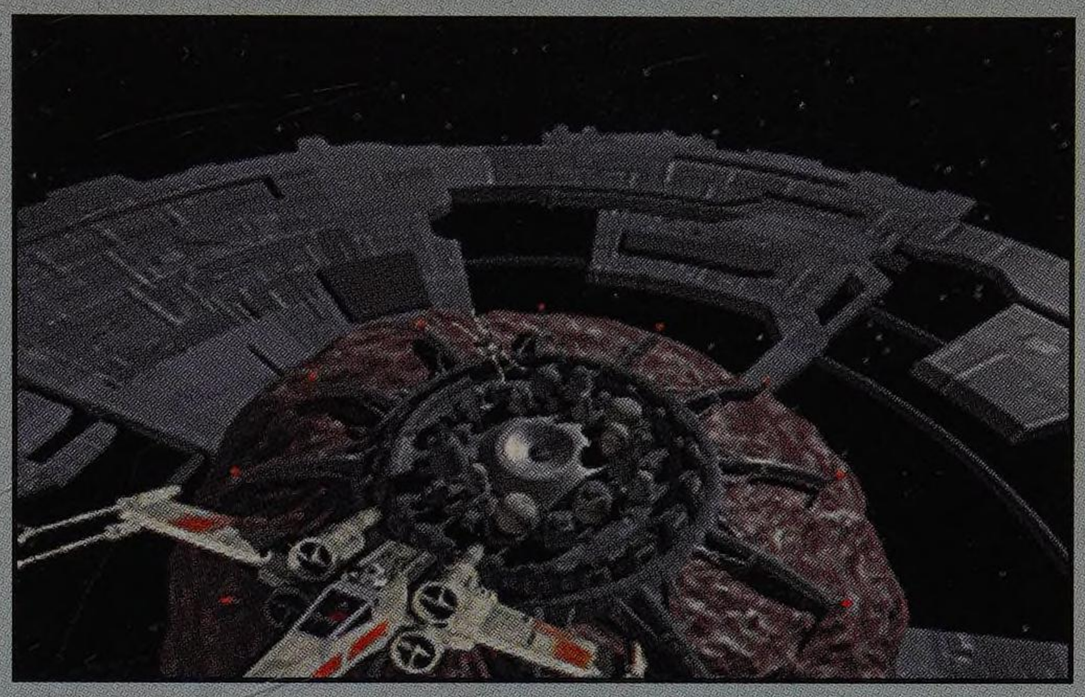
Colon created wire-frame versions of the exterior and interiors of Chapter 13. This is an interior tunnel.

And here's the final 3D-rendered version of the tunnel that went to Vince Lee to be placed into the game.



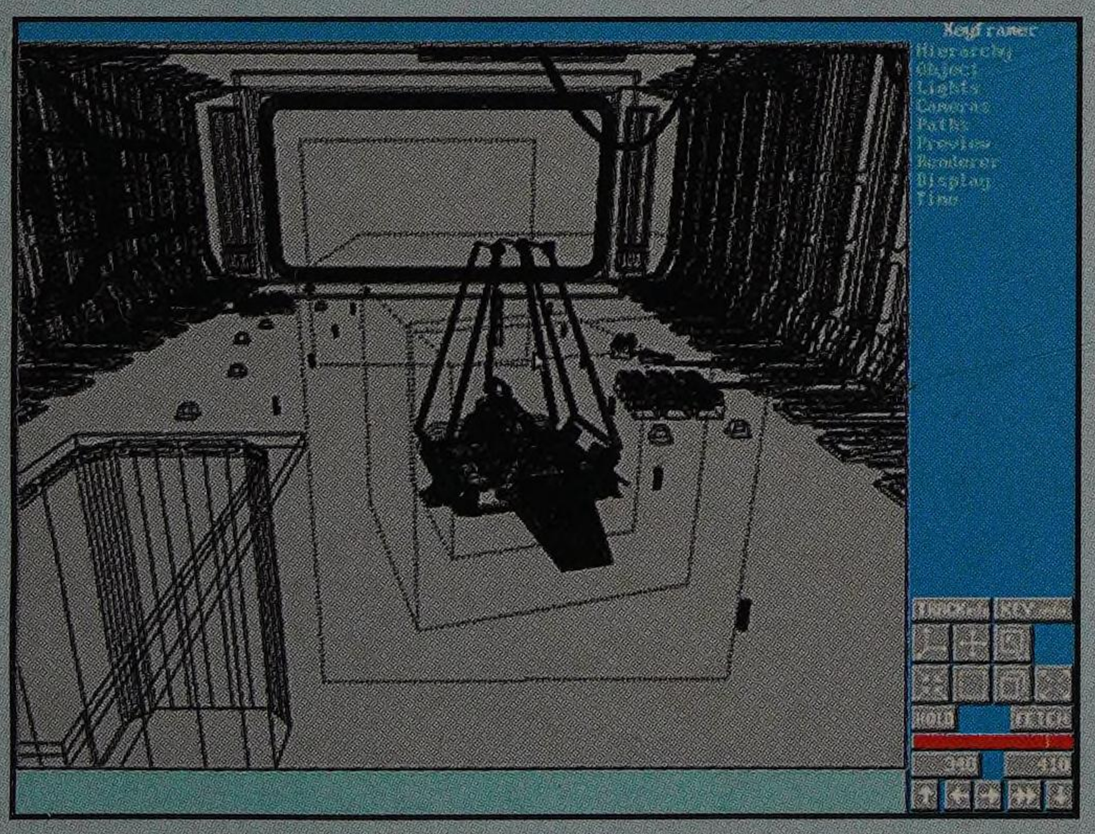
All of the Stormtrooper targets that you meet up with on the ground levels in Rebel II *are computer animated, like the ones you see here from Chapter 2. "It's easier to get all their falls and dodges and entrances to line up with the computer," said 3D Animator Eric Ingerson. "I used the same basic entrance, dodge, and death animations as starting points in Level 2 (the mining base) and Level 11(the corridors of the Super Star Destroyer) but ended up having to tweak and adjust most of the motion to avoid obstacles. There is an inordinate proportion of left-handed stormtroopers in the mix because many entrances could be done most easily by just mirroring my existing animation."*

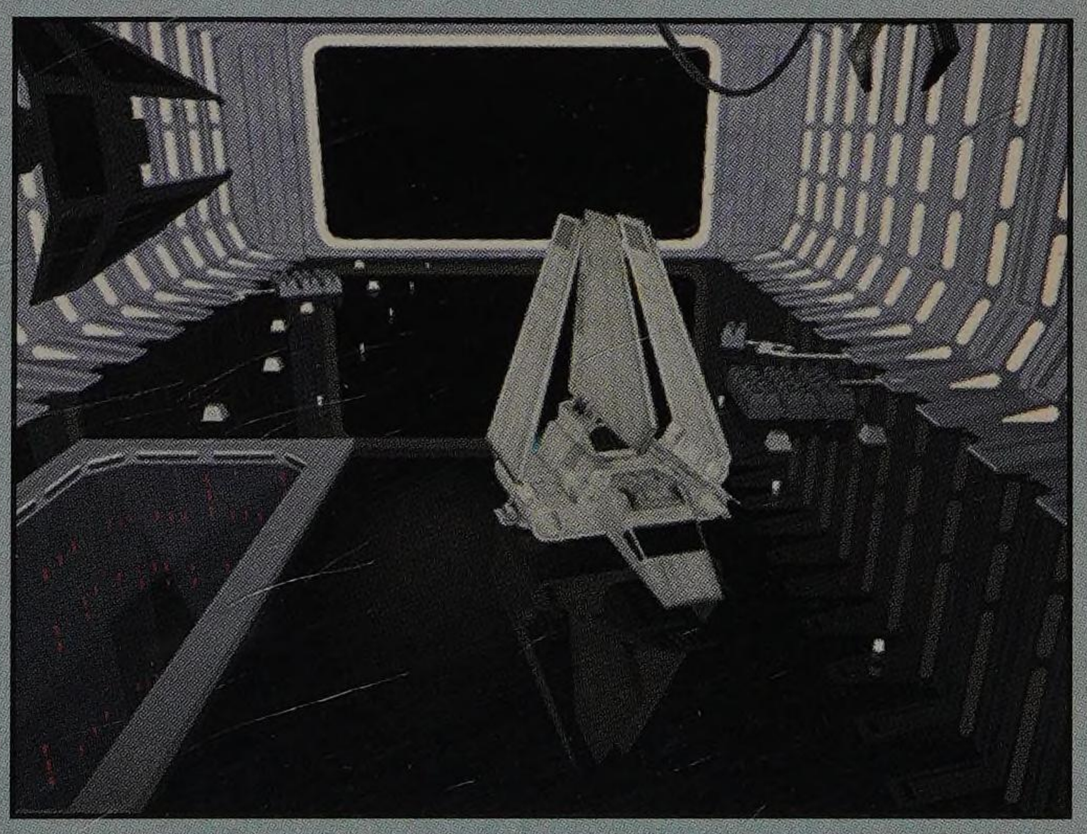




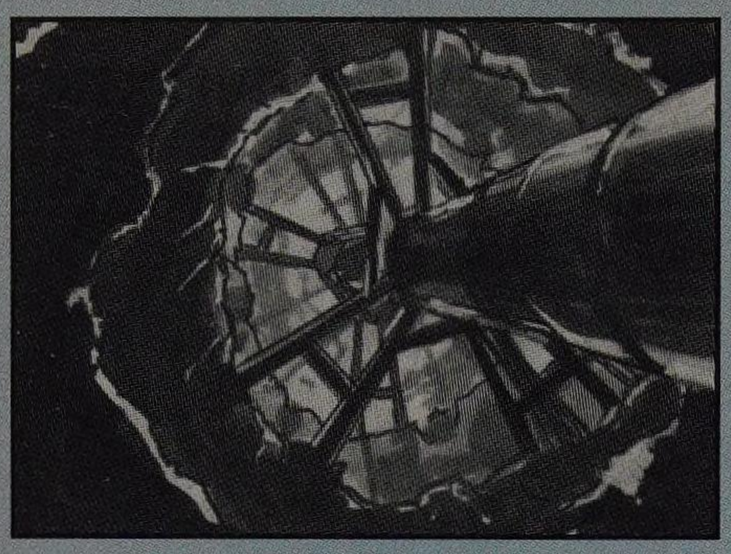
This sequence, created by Lead Artist Richard Green, shows the wire-frame drawing of the asteroid mining base in Chapter 6, the wire-frame drawing of X-wings escaping from the base before it explodes, and the composited and fully rendered shot as it appears in the game.

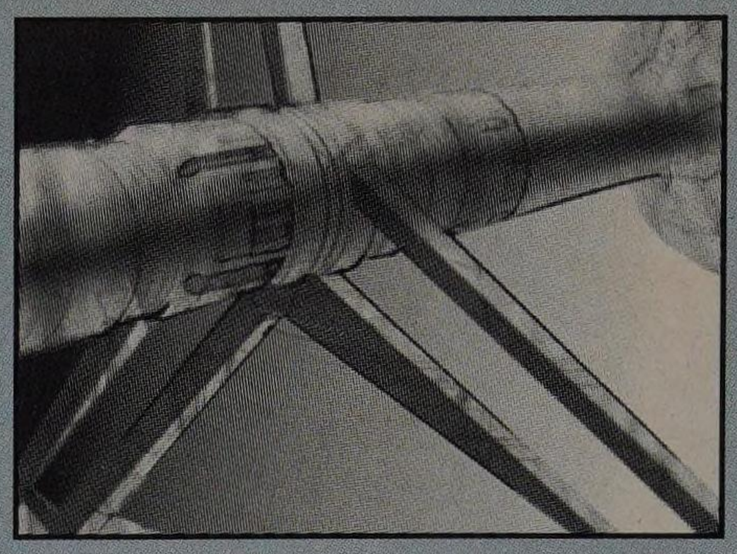
"I wanted to do something big for Chapter 6," Green said, "which is a real challenge after the destruction of the planet-like Death Star. I envisioned some sort of structure attached to a large asteroid, and Jon Knoles and I landed on the idea of a Saturn-like design at the same time. For this shot, I was thinking of the shot in Return of the Jedi *in which the* Millennium Falcon *races out of the exploding Death Star as the camera tracks backwards with it. It works great here since it reveals the base in a very dramatic way — and then of course you get to see it explode."*

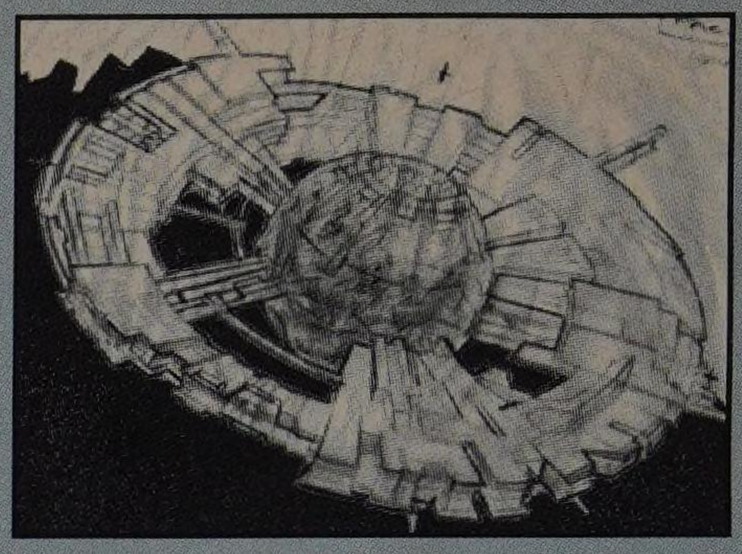




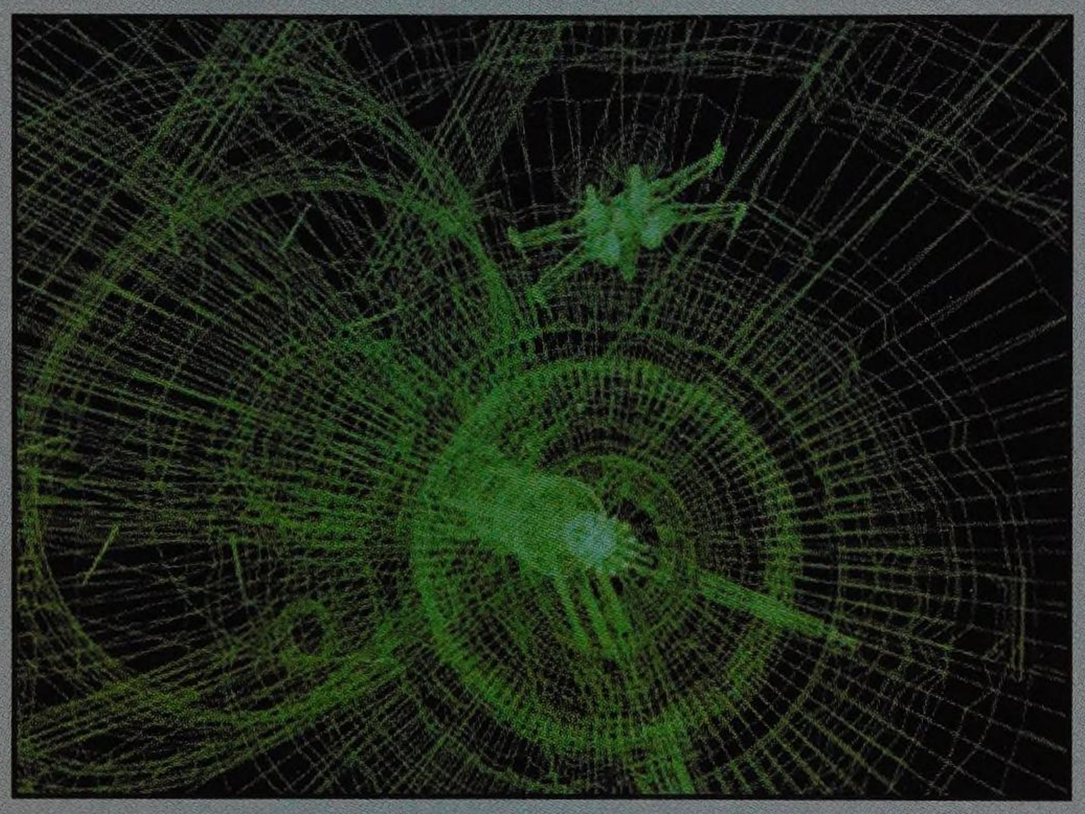
Artist Garry Gaber created this cut-scene shot of the Tydirium *shuttle landing in the Super Star Destroyer. "The shuttle was pretty special to me since I had modeled it and the hangar from scratch using Industrial Light & Magic photographs and films for reference."*

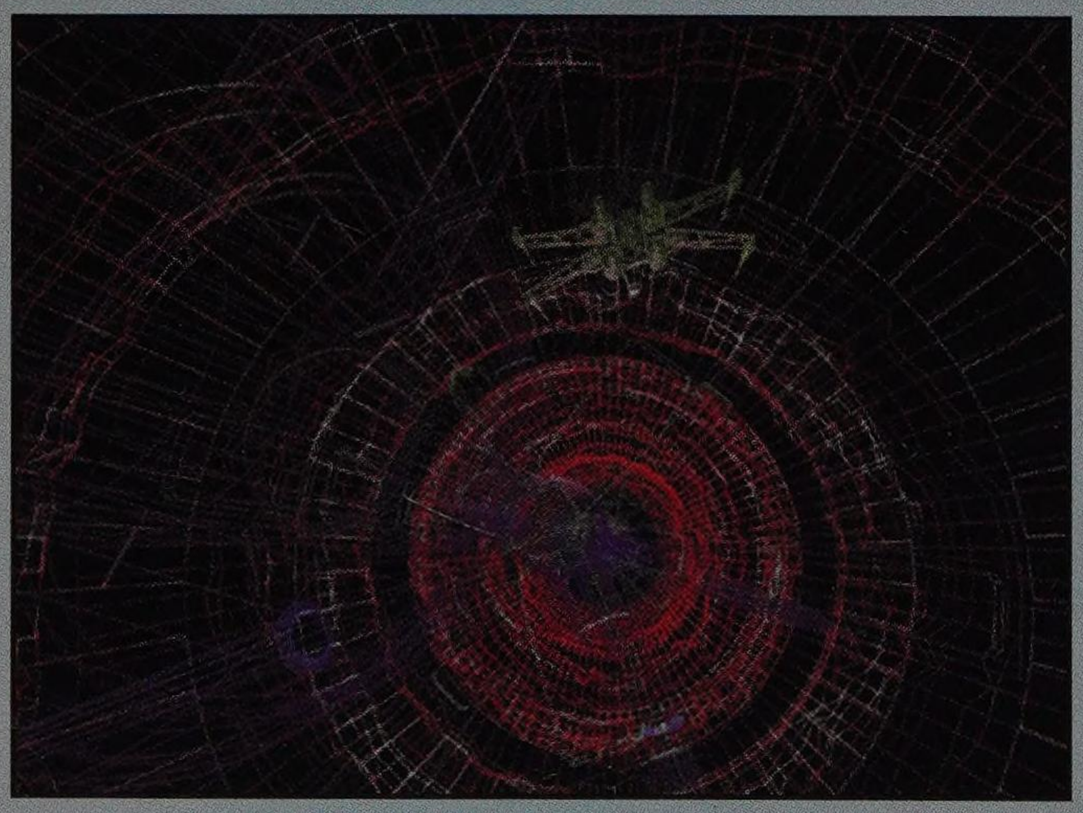






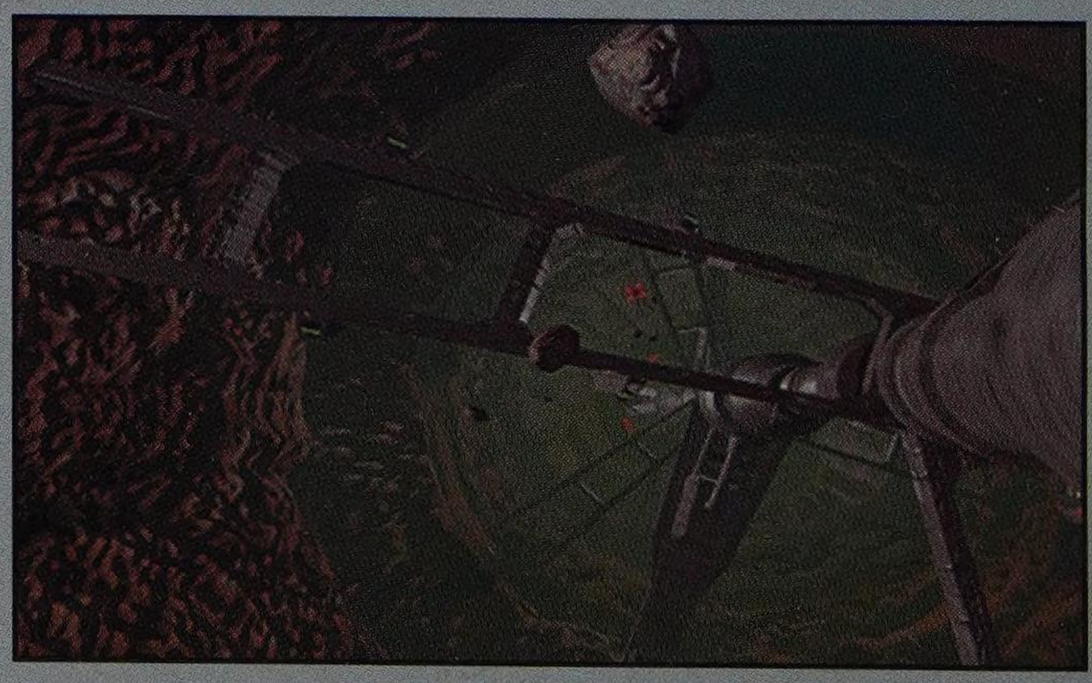
Artist Jon Knoles describes how the Chapter 6 asteroid mining facility was created: "We envisioned a huge machine that completely surrounded a rather large asteroid. Richard Green built the 3D model of the exterior from a sketch I drew."

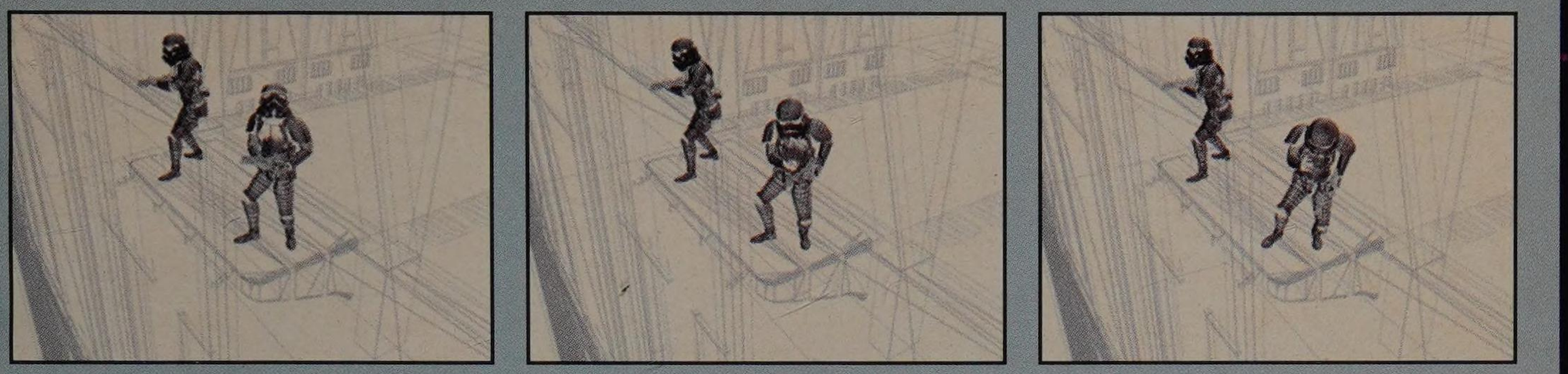


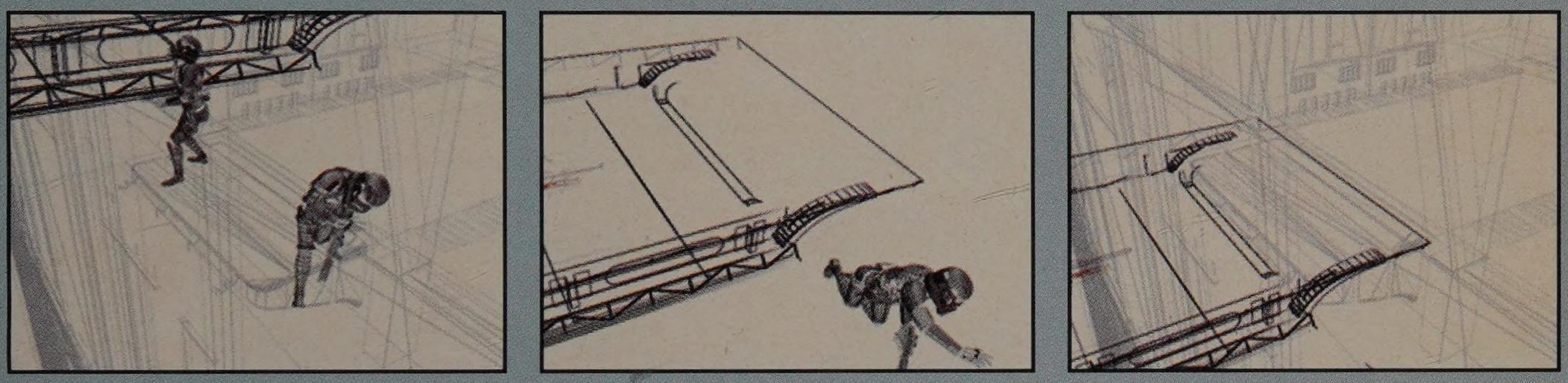


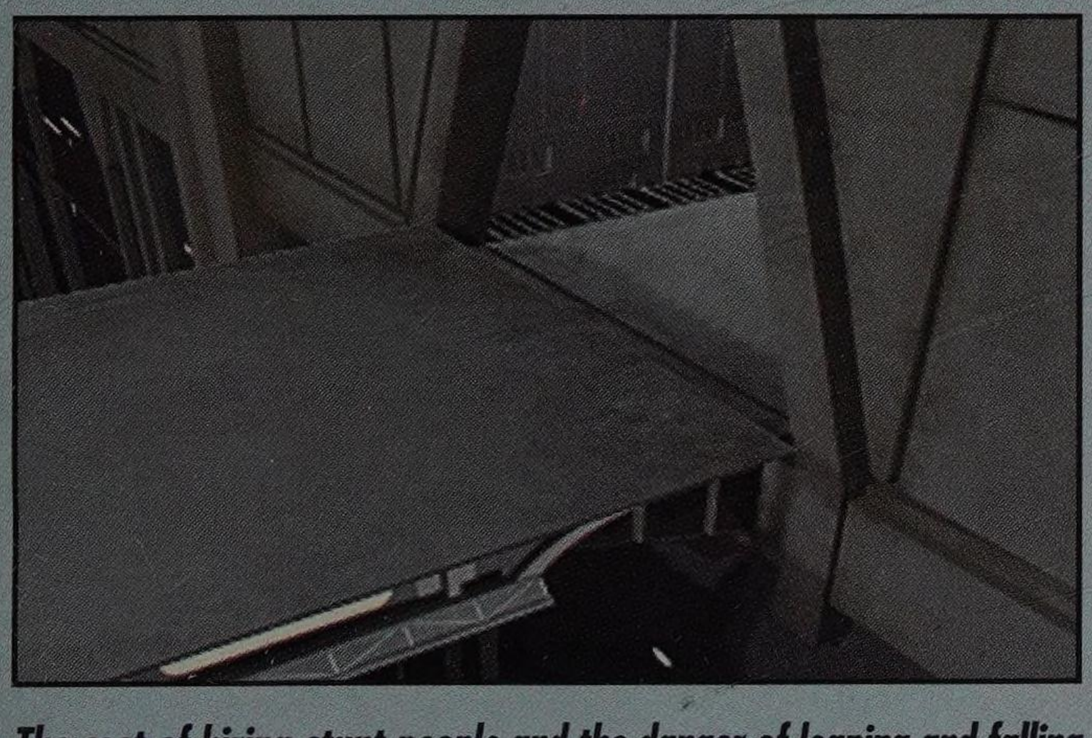
"I envisioned these massive spinning arms that would dig out rock from both sides of the shaft," Knoles said. "Automatic sentry guns guard against rocks breaking free and threatening the structure.

"Rebel pilots must negotiate the shaft, destroy the sentry guns, blow up the generator at the far end of the shaft, and fly out quickly. There is a dim, eerie green mist in the shaft caused by lights from the generator and sentry guns illuminating the dust that fills the shaft."



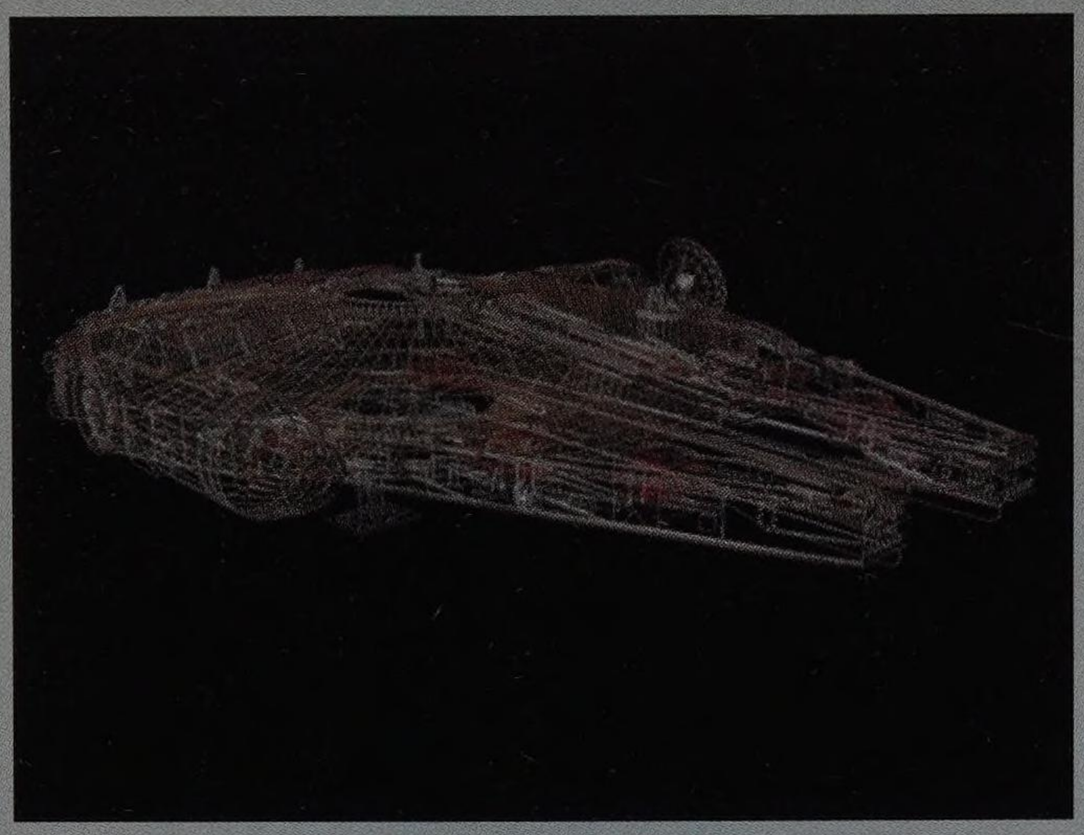


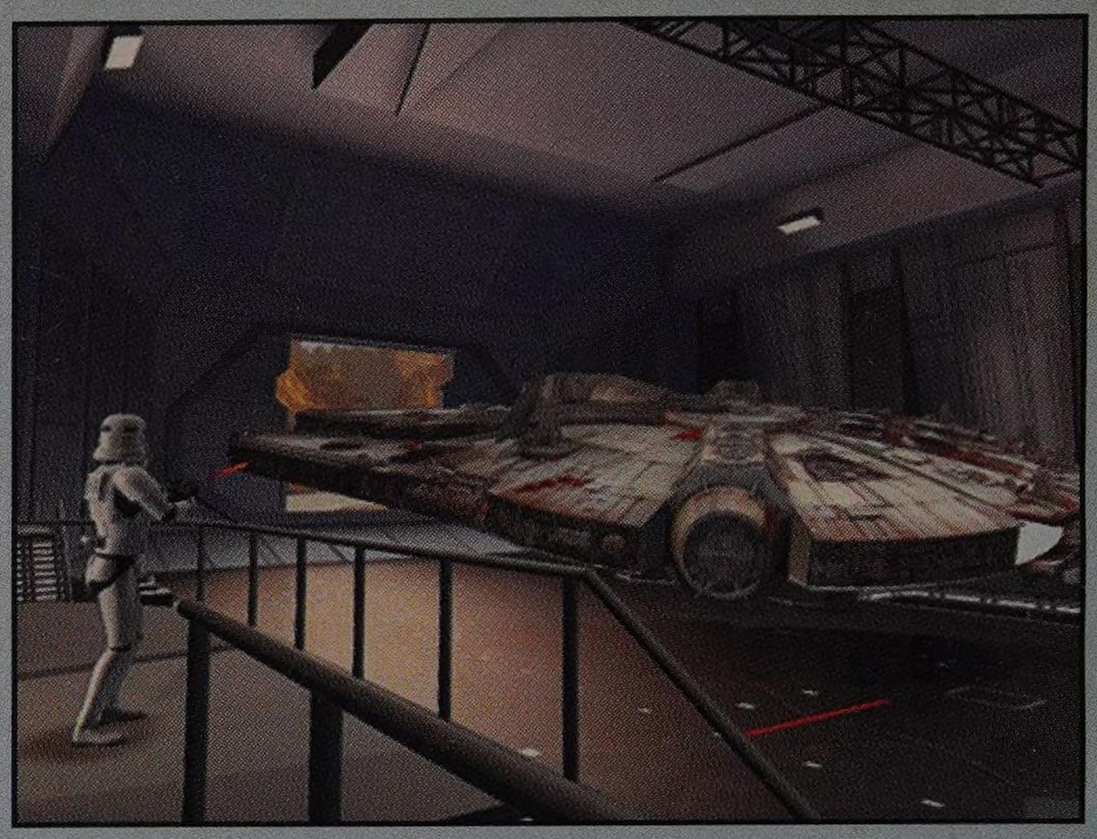




This sequence of shots, called the "bridge-crunch" scene by Ingerson, shows what goes into animating a fall. It was "particularly fun to do," Ingerson said. "The troopers realize they are in big trouble just a bit too late," he said, "and so respond inappropriately in their departure. We wanted to have one trooper fall or leap from the ledge, but in a realistic manner. You wouldn't just leap into an abyss to save yourself. It would look silly. So I decided to have him dodge to the side in desperation, only to find thin air — and his doom."

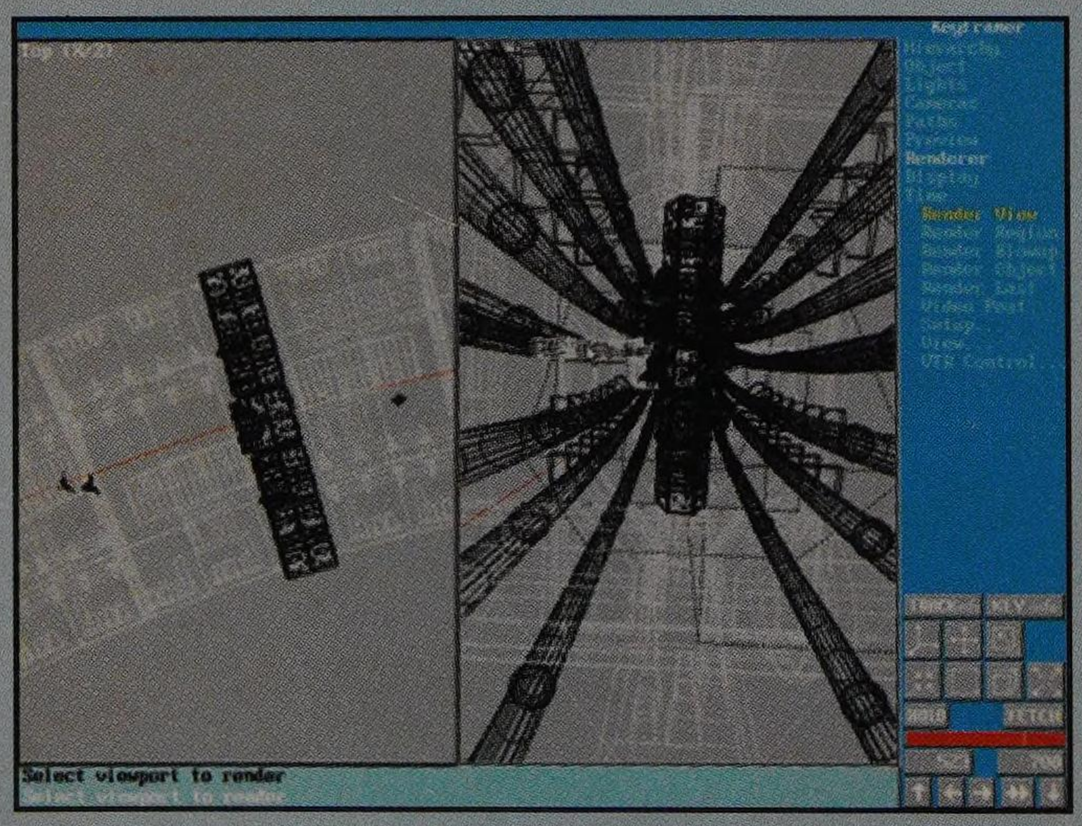
The cost of hiring stunt people and the danger of leaping and falling in cumbersome, oddly-contoured stormtrooper outfits required that all stunts be computer animated. All stormtrooper falls were accomplished by animating Ron Lussier's detailed wire or mesh drawing of the stormtrooper. "This model appears throughout the game," 3D Animator Eric Ingerson said. "All the long shots of stormtroopers use this mesh, and even some close-ups do. Any shot in which the stormtroopers don't look encumbered by clumsy armor and half-blinded by the helmet is probably computer generated."

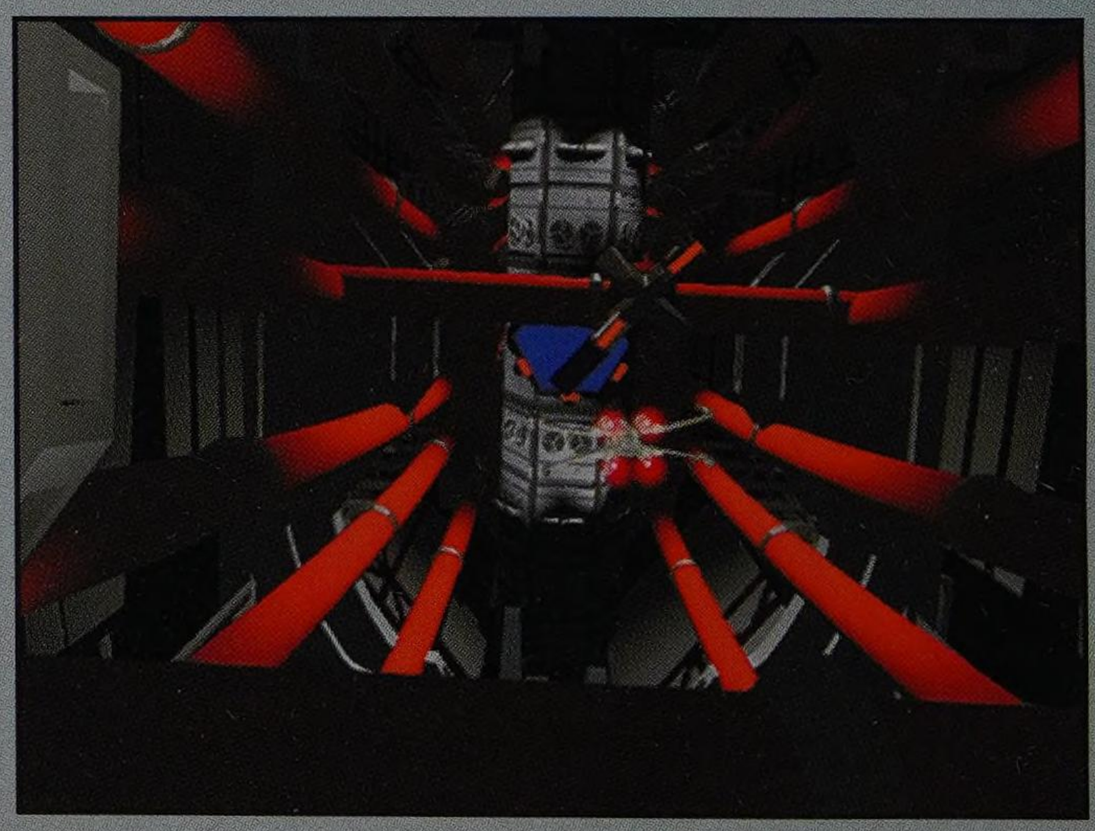




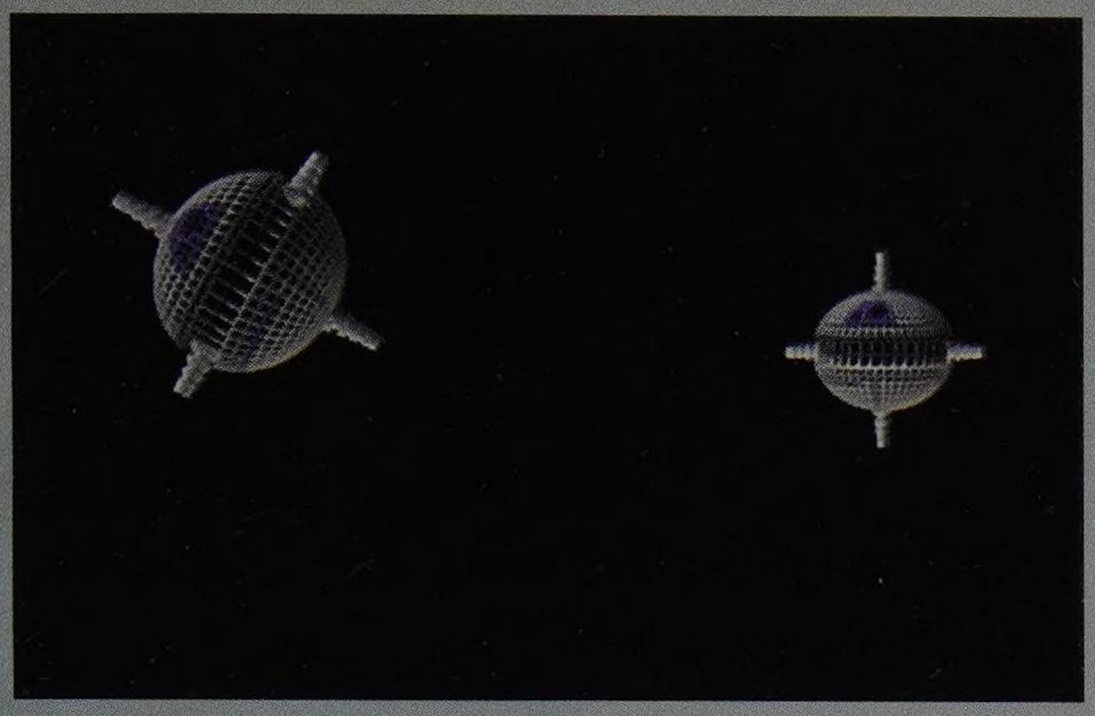
If you think this is the **Millennium Falcon**, *you're only partly right. Artist Ron Lussier created this bird to look just like the famous* **Falcon**. *"The* **Millennium Falcon** *was a model I had always wanted to build, but we hadn't a need for a Corellian freighter before* **Rebel Assault II**. *The ship in the game isn't actually the* **Falcon**, *per se, but a similarly modified Corellian freighter."*

"The 3D technology has improved so much in the last two or three years," Lussier said. "The abilities of the improved engine (thanks to Vince Lee), double-speed CD-ROM (thanks to the industry), new features in 3D Studio (thanks to the Yost Group), video characters (thanks to Mark Christiansen for the great video work), a much larger team (thanks to all), and the experience and techniques gained from doing the first game made it easy to blow **Rebel I** *away."*

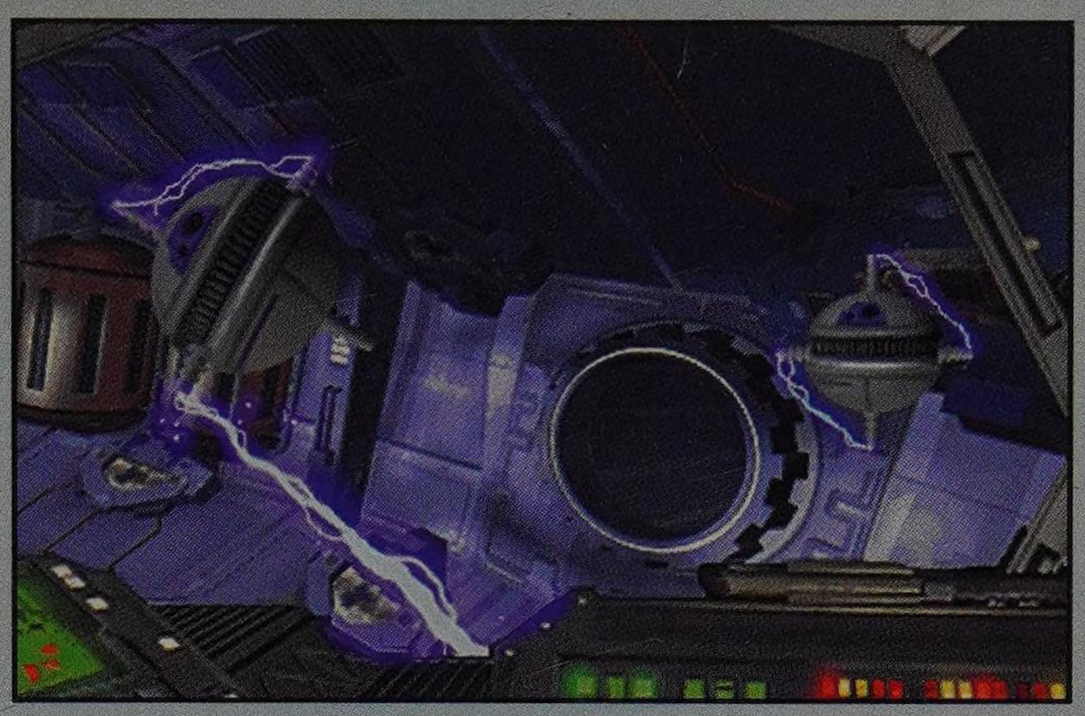


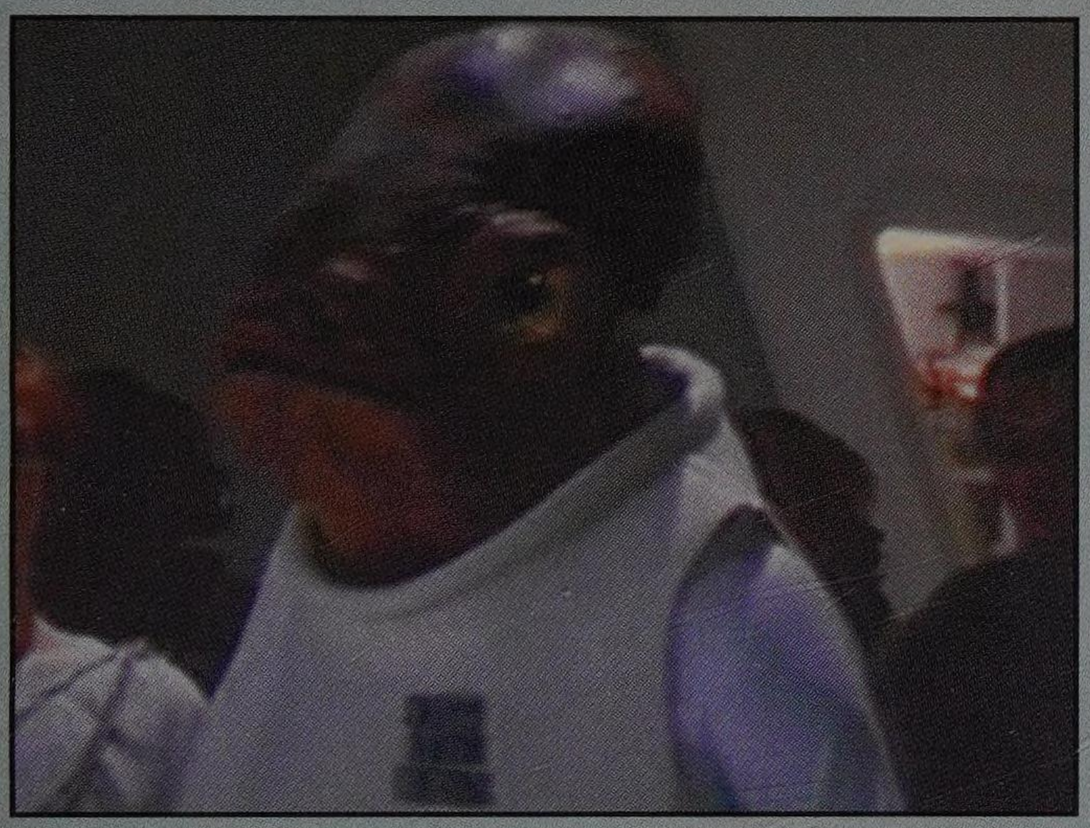


For Chapter 6, 3D Animator Garry Gaber created a maze of pipes and supports to fly through. "I didn't realize how much of my industrial design background I would utilize when designing sections like this," he said, "but it really came in handy."

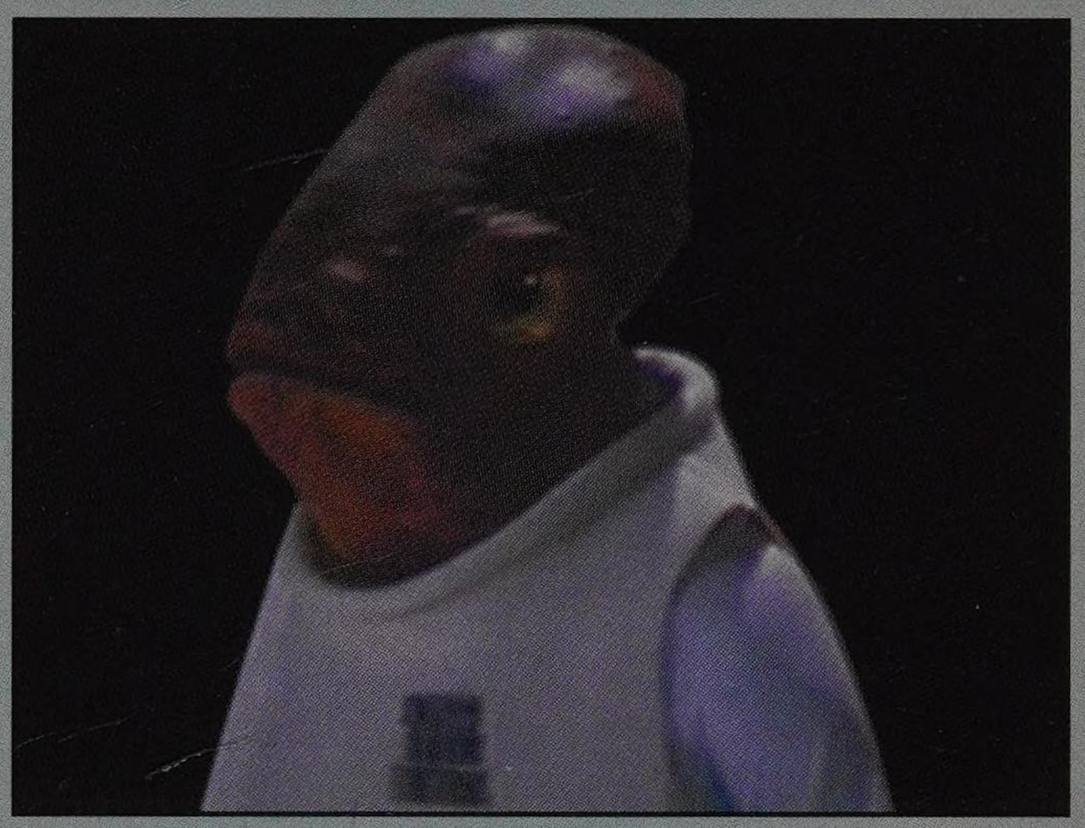


3D Animator Clint Young drew Imperial targets like these for the game, an activity that "was as much fun as shooting them," he said. The movements of the remotes is very close to the movement of the Jedi trainer from Star Wars. Young's favorite targets are the lightning droids in Chapter 13, which were "surprisingly the easiest to design," he said.





For the Admiral Ackbar segment, Video Technician Chris Weakley had to clean up the original Return of the Jedi footage, which was hazy and off color.



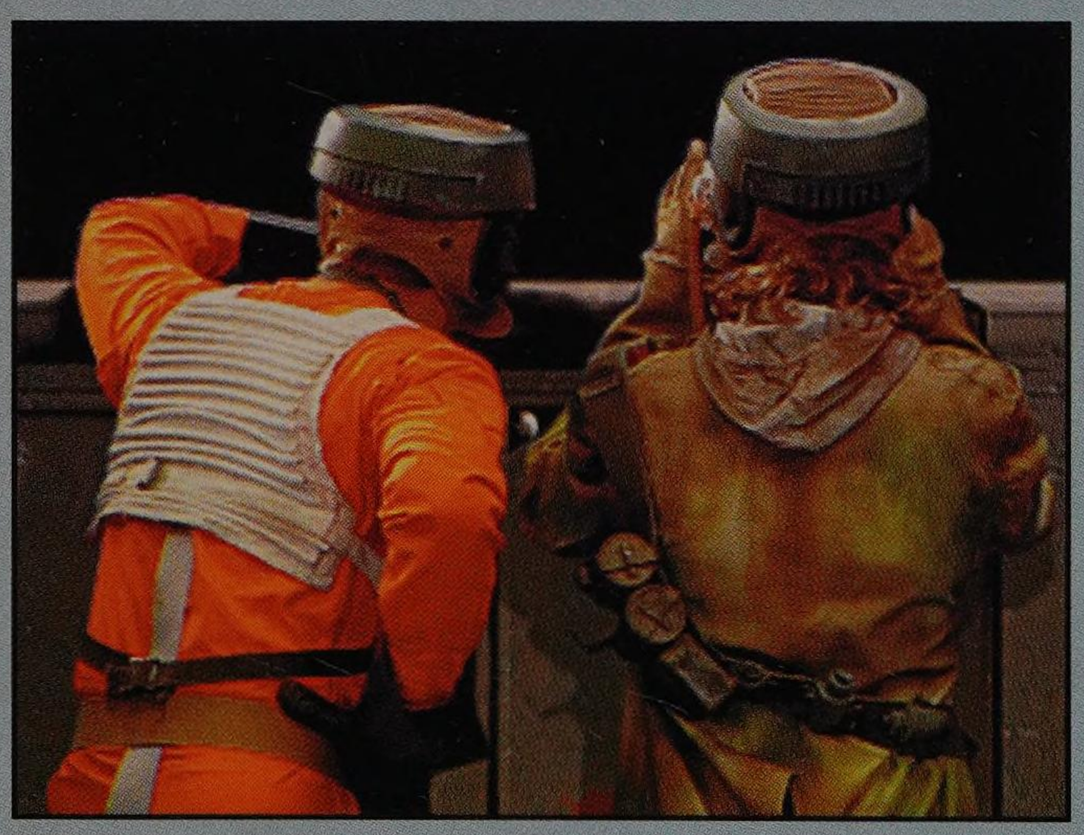
The first thing Weakley did was isolate Ackbar and crop him out of the movie background...

...then he superimposed Ackbar's physique against the Rebel II's animated background.

Finally, he added warmth to Ackbar's face so that his coloring would better match his new surroundings.

This sequence shows how Video Technician Mark Christiansen combined video with a 3D-rendered background. In this image, the two actors are being shot against a blue screen leaning on a bar.

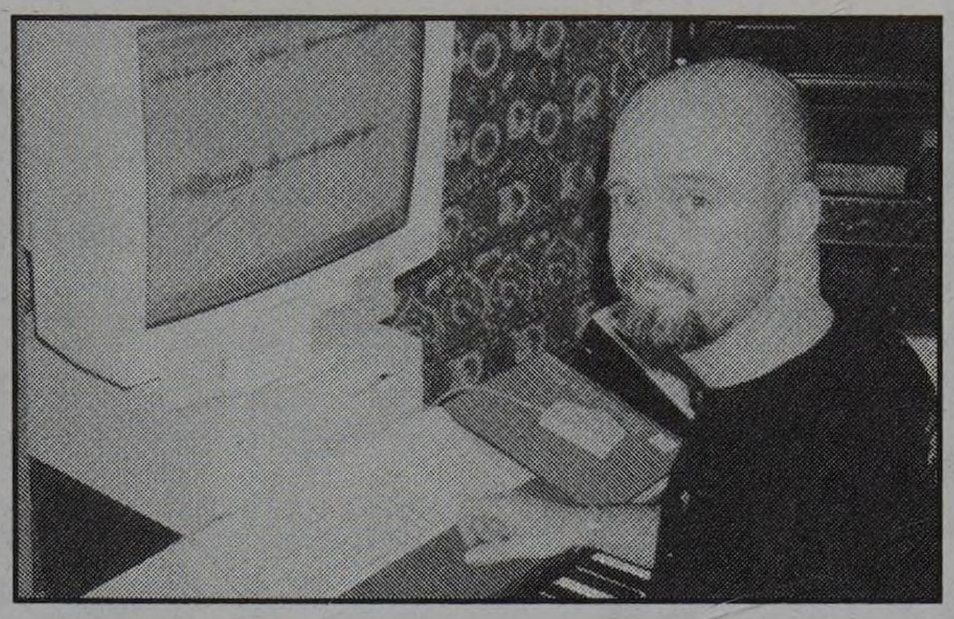
Christiansen then combined the actors with a 3D-rendered wall. Notice that the blue bar in the first image is now the top of the wall. Can you pick out a remaining problem?



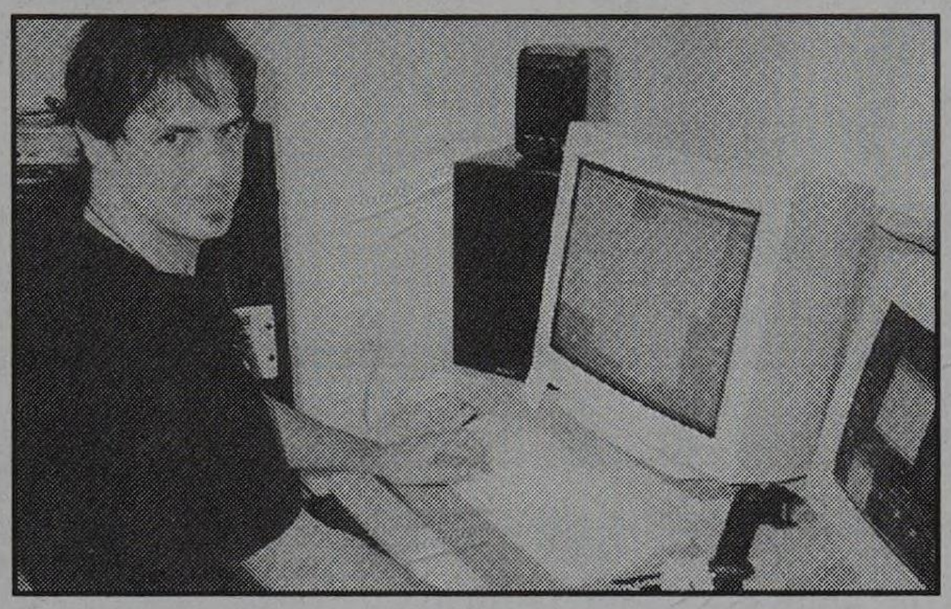
The problem is that there are shadows on the bar, but not on the wall. Here you can see that Christiansen fixed it by adding the actors' shadows to the wall.

Finally, Christiansen brings the last element into the frame — the rendered 3D background complete with shuttle — and the entire picture is checked for proper color matching.

minutes of video per CD. That's not much. There's a fair chance that we may push it to two CDs. [Steve feigns concern and disbelief.] There was about 40 minutes of video in *Rebel I*, although actually the whole thing could be considered video — it's all either 3D animated video or the shot-on-film type of video. In *Rebel II*, running at one-and-a-half speed, there is about 60 minutes.



***Peter McConnel, who composed some music for the LucasArts game* Full Throttle, *was the musician who digitized John Williams' score for* Rebel II.**



Sound man Larry Oppenheimer (aka "Larry the O") created a voice- and sound-effects library that Lee drew from to create the game's soundtrack.

Did you have similar technical hurdles with sound compression?

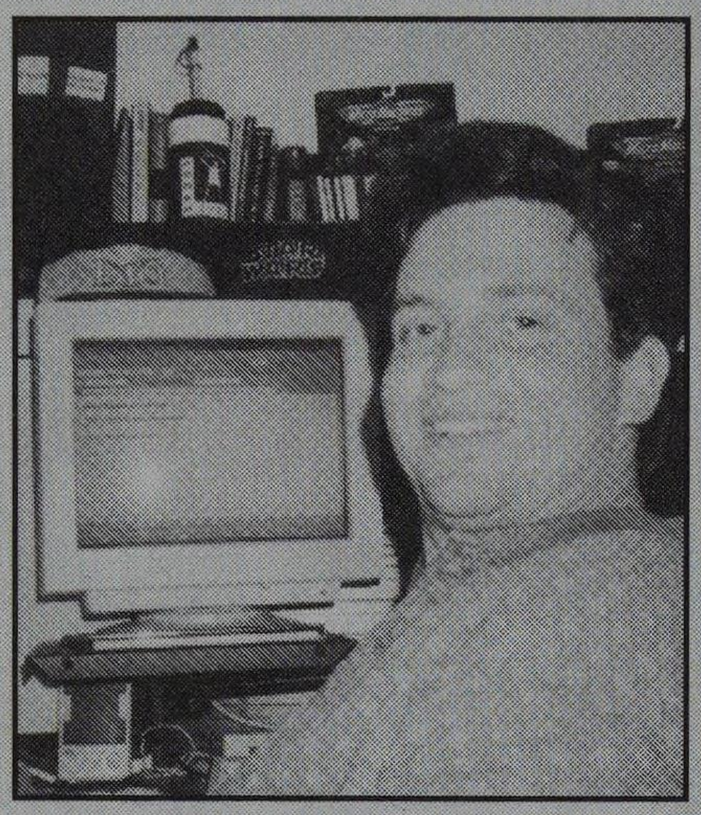
Vince: Sound by comparison isn't nearly as bad a problem as video because video inherently contains so much more information. The trick with sound was finding ways to get 10 channels out of sound cards that have only one inherent channel. That's not a trivial problem. It's a complex mixing process where you mix the sounds together, making sure they maintain good volume. The most straightforward way to mix them makes it so each of the sounds loses quality every time you add another channel.

Steve: We're only using the digital audio chip (DAC) on sound cards because all of the music on *Rebel II* is all digital music. That makes it a little easier. There's no

REBEL PROFILE

STEVE DAUTERMAN

Executive Producer



Steve Dauterman

How does someone with a financial degree from the University of Colorado and a two-year stint as an auditor in a Big Eight accounting firm in Denver wind up as head of game production for one of the industry's hottest publishers?

"Good question," says Steve Dauterman, 30, director of production at LucasArts since 1992 and executive producer on *Rebel Assault II*. "I don't know."

It was in 1989, during his Denver auditing days, that the native of Columbus, Ohio, happened upon a newspaper ad for a financial analyst at Lucasfilm, the parent company of LucasArts. "I had realized that accounting wasn't my life choice of what I wanted to do," Dauterman said. "I came out for an interview at Skywalker Ranch and instantly realized that this is where I wanted to be. I had a great interview, got the job a few weeks later, and moved myself out here."

He was in California and at Lucasfilm, but Dauterman was still many income statements away from software production. After two years of lassoing corporate budgets, he became financial manager for the game group, then called Lucasfilm Games. He was still the numbers guy, but at least he was in the belly of the software beast. When he arrived at Games in 1991, "it was a pretty small operation," he recalled." They hadn't released many games and were just working on *Loom* and *Indiana Jones and the Fate of Atlantis*." These two titles, among the first graphic adventures, marked the start of the company's rise to critical and financial success.

While he was churning the numbers, Dauterman worked closely with the game producers, learned the ropes, and began to envision producing games himself. A year later when the head of production left, he was asked if he wanted to fill the position. "Of course," he responded, "as long as I can get out of accounting, I'd love to."

As the director of production, he is responsible at any one time for 10 to 20 projects in various stages of completion. Several production managers report to him. "They are my eyes and ears on the games. We manage budgets, schedules, resources. We work closely with the project leader and lead artist to meet their needs. We work closely with the art department manager to find the 3D artists and art technicians we need. We work with the director of technology to find programming help on a project. We do whatever is necessary to help the development teams complete their projects."

As an executive producer, his credit for *Rebel Assault II*, Dauterman does similar work — he just gets deeper into the trenches. That means "problem solving and conflict resolution" on a day-to-day basis. It doesn't mean he's a dominant creative force in the games. "It's not my job to get in there and muck with the design," he says, "In fact, I consciously avoid it. I let the guys like Vince — and everybody else who knows what they're doing in terms of building a game — do it. I'll always throw in my two cents, but I don't look at it as an overriding part of my job to tell people how to be creative."

The hardest part of the production process, according to Dauterman, is keeping people interested and motivated for the 18 to 24 months it takes to complete a project. "It can just wear you down," he says. "There are always a lot of unknowns going in, and

MIDI, synthesized type of orchestration that you find in many other games.

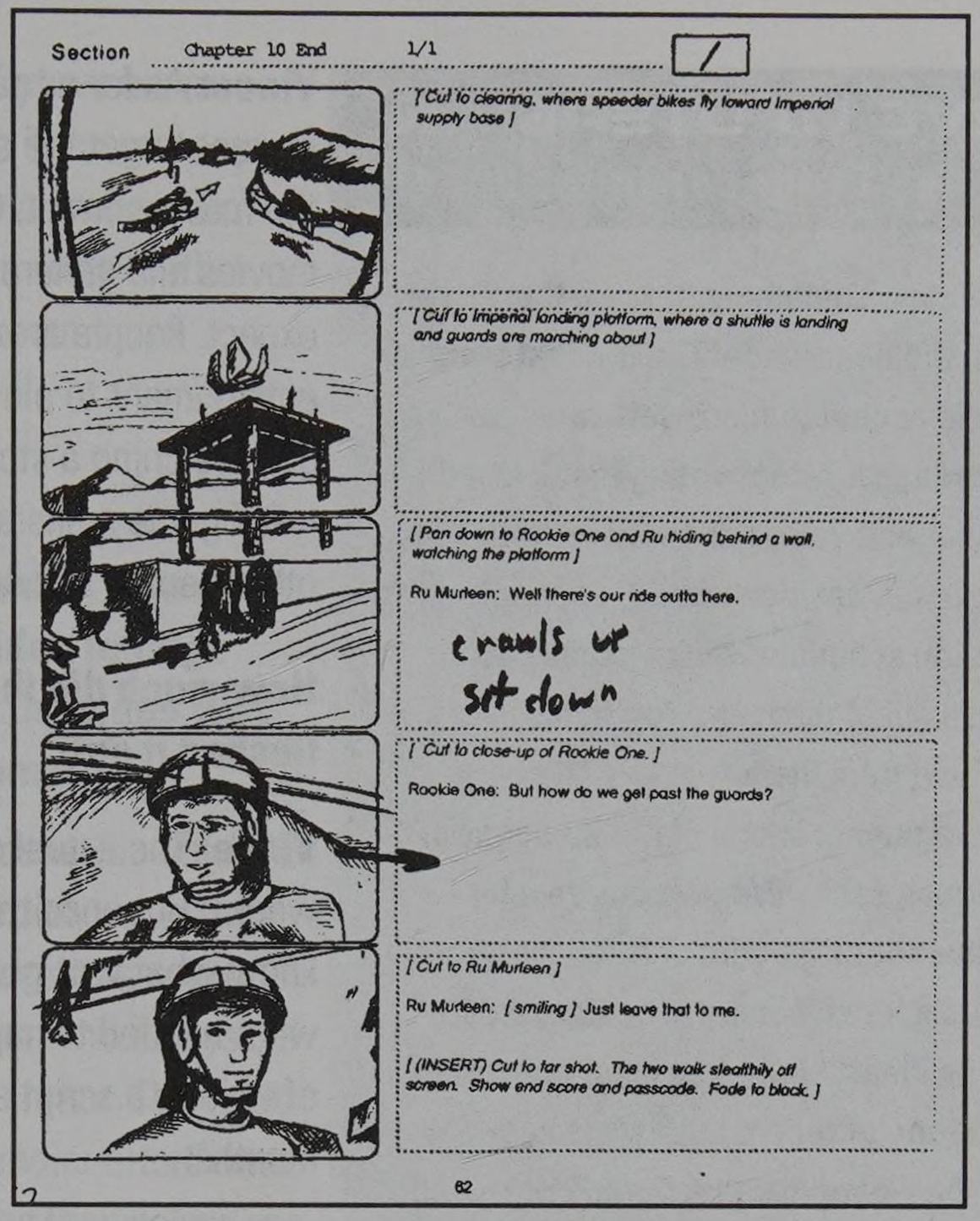
Vince: I think digitized music is the way the industry is moving. Synthesized music, no matter how good a synthesizer you have, still sounds like synthesized music until you get to the really high end. But with a reasonable amount of effort, you can digitize a real instrument and it will sound like a real instrument even on a very inexpensive sound card.

Where does the soundtrack for *Rebel Assault II* come from?

Steve: *Rebel Assault II* is again using the original London Symphony Orchestra version of John Williams' score from the movies. We're in the process right now of getting one of our musicians to take the soundtrack, digitize it, and then Vince will use that version to cut and edit the music into the different sequences of the game.

Vince: The first game took all its music from *Star Wars*, but now for the new game we're going to use music from *The Empire Strikes Back* and *Return of the Jedi* as well. There's plenty of material to pull from.

Steve: Because we're using the sound tracks from the movies, the music portion is probably less involved on this project than others because most games usually have some original composition. Because we don't have composition, the work is primarily getting the digital music and sound effects to Vince so that he can lay them in.



A page from* Rebel Assault II's *original storyboard by Vince Lee

THE STORY

You mentioned that one of the "turn ons" for you was the chance to create a new story. How did the story for *Rebel II* evolve?

Vince: Unlike how you might create a movie, in a game, the gameplay is more important than the story. So really I asked for a lot of ideas from people around the company and got together and just brainstormed.

REBEL BRIEFING

Hal is Hal Barwood, a former Hollywood screenwriter and movie director who is now a project leader at LucasArts.

Steve: Around here we've always focused first on "what are you going to do" [technically] before the story and the dialogue. For the story and the dialogue, we have a lot of help around here, different people who have the skill to give Vince whatever support he needs. Hal is always a good person to bounce ideas off.

STEVE DAUTERMAN
Executive Producer (continued)

you're always creating something new, so there are always problems and dead-ends. The hardest thing to do in software is accept that it is software. You almost have to manage it by accepting that it is a difficult thing to manage. If you try to force too much in the beginning and from day one are riding people about the production schedule, you're usually going to frustrate the hell out of them and you're not going to get anything from them."

Hands-off management is one of the company's strengths, Dauterman said. "We give our development teams a tremendous amount of freedom. When you give designers a lot of leeway to design, they come up with good ideas." Freedom must be working because the string of recent LucasArts successes — including *Rebel Assault, Dark Forces,* and *Full Throttle* — is the envy of the industry.

These successes are not the result of any magical LucasArts credo for game design. In fact, after three years at the helm of game production, Dauterman insists there is no such thing as a LucasArts design philosophy or formula. "If there is," he says, "it's trying not to follow one. Each project is different. I've always been a big sports fan and use the sports

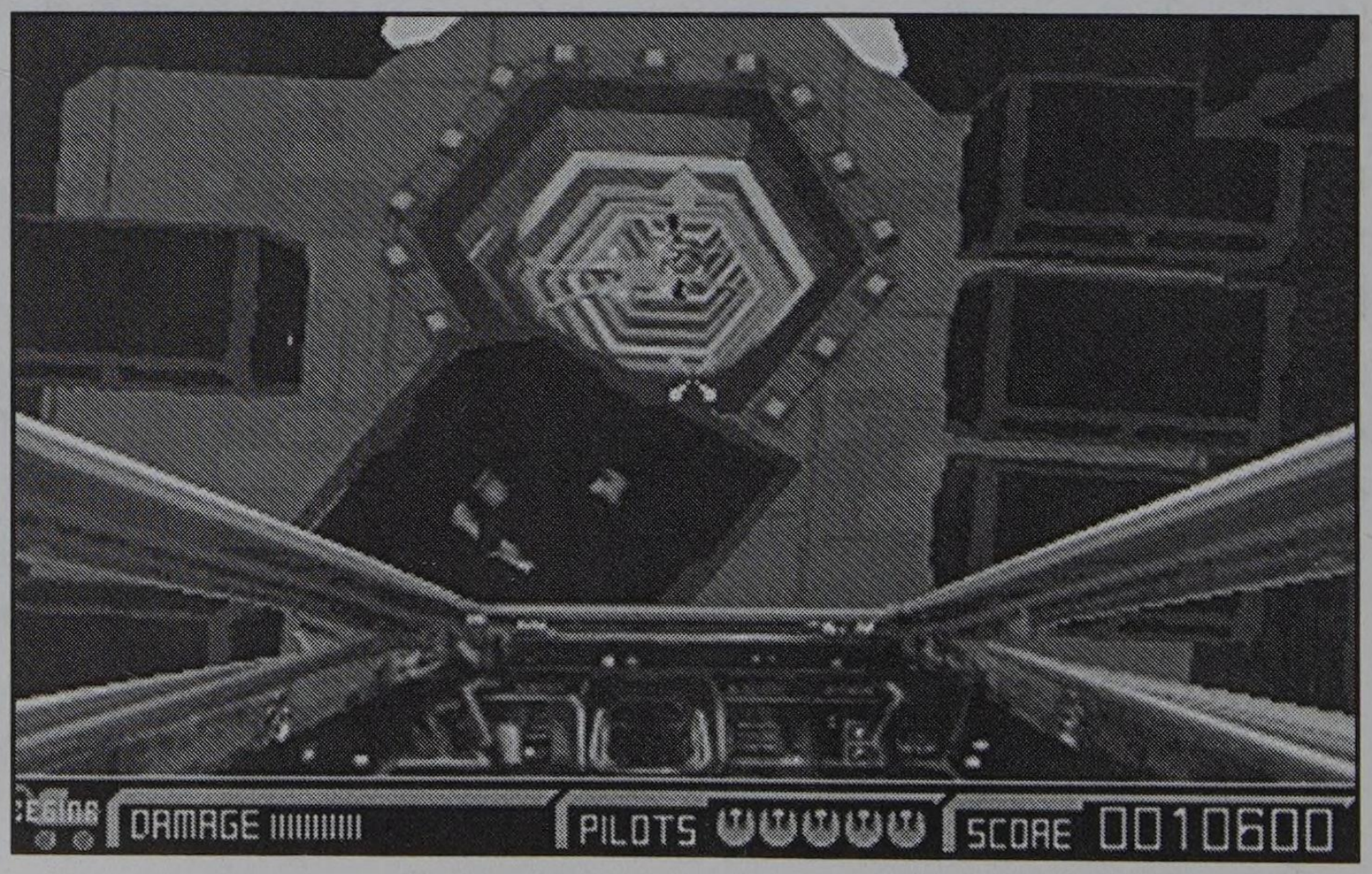
Vince: As far as game design goes, it's much more important to get the environment down, to get the feel of the movie correct, to get scenes that feel like the movies and general surroundings true to what people expect. People are more interested in being put into an environment to play a game than they are in sitting back and watching a story. I think that's a mistake made by a lot of game makers — they think people want to watch other people talk on screen and interact.

How much did the story change once you had flushed it out?

Vince: The actual story itself evolved over a couple of weeks. But once the actual levels were set and we knew what was going to happen, it was pretty obvious what needed to happen storywise. It took about six months.

Being a *Star Wars* derivative, did you have any story difficulties with the powers-that-be who oversee such things?

Steve: We submitted a script, and inevitably they'd come back with "change this or change that, a Rebel soldier would never do this." They'd say that "in such-and-such novelization, this is what happened," or "in a



Inside Level 6: Mining Base

roleplaying game, they mention this." But we understand that there has to be some of that. The company does want to have control of the *Star Wars* universe. They want to make sure that our games don't conflict with other products and stories that are out there.

GRAPHICS

Let's get into the "spectacular graphics" you mention, which are a combination of video footage and 3D computer animation. Since the video was new to you, did it cause any problems?

Vince: We have a lot of nonplayable scenes in which we have characters speaking from cockpits, doing their normal cockpit chatter. They were relatively easy to do. But there were some scenes that required more physical acting and they were more complex to create. The video did take a fair amount of time, but the major effort went into the playables because the playables themselves are all 3D animation, and they're just gigantic animations — some as high as 2,500 frames.

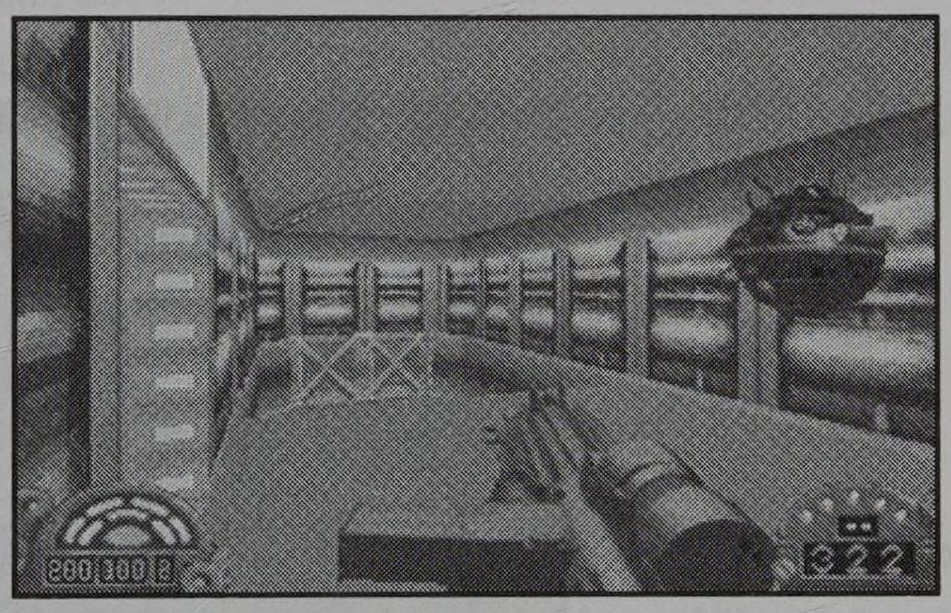
Can you give me an example?

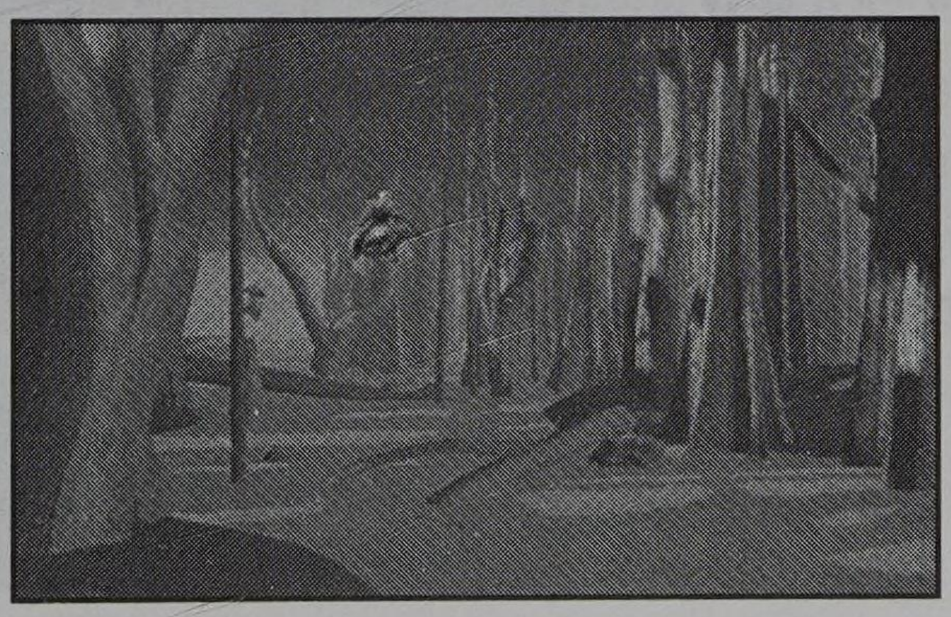
Vince: Take Level 6. You're flying inside a mining base, and you fly into its conduits to shoot out the shields. You go around and around inside this thing, and then you enter its reactor core where you go into its machinery and have to blast away and then come out. First, on a model level, that whole environment had to be created — every single hallway, every single corridor, every single strut that you pass by. We did what we could to duplicate detail. You make one piece of detail like a strut panel and then you duplicate it around, but still, all that has to be laid out, figured out, and lit. And then your flight path has to be animated through that. So first there's the modeling step to create that huge

REBEL PROFILE
STEVE DAUTERMAN
Executive Producer (continued)

analogies. You've got to take the good coaching approach, which is to look at the talent you have, emphasize your strengths, and be sure to fill in any weaknesses. We tend to look at building projects around here as 'casting,' and we make sure that we try to cast the right person with the right project. For example, each project leader has different strengths and weaknesses. Some, like Vince, are very good programmers. Some of them, like Hal Barwood, are much better at story development and puzzle making. The one thing I've found is that if people are excited about the project, you're going to get the most benefit out of it as opposed to management saying, 'Well, we've got to build a game just like this and here's your job, go do it.'"

What is it that most delights this former auditor turned producer? The bottom line, of course. Making megahits on minibudgets is "probably one of the things we're most proud of," Dauterman says. "I'm





The look of two hits.* Dark Forces *(above) uses simpler graphics to create a 3D world you can explore forever.* Rebel Assault II *uses more complex graphics to increase the sense of realism — but at the expense of control.

REBEL PROFILE
STEVE DAUTERMAN
Executive Producer (continued)

always looking at the cost benefit. Where do we want to spend our money? If it made sense to spend $10 million on video, we'd do it. But for *Rebel Assault II*, it didn't make a lot of sense to spend millions of dollars on video. We knew that we could get the quality we wanted — especially for the game experience — with far less. A lot of companies spend a lot of money on non-game areas, but I think it comes across to the consumer as 'Wow, they spent a lot of money on that, but it didn't really do much for the game.' We try to spend the money where it counts — and that's on the game itself. If my accounting background helps anywhere, it's being very conscious of the financial impact of whatever decision we're making."

Dauterman's decisions — whether it's to leave accounting for Lucasfilm or spend the money on gameplay instead of whizz-bang extras — have benefitted both him and the gaming community.

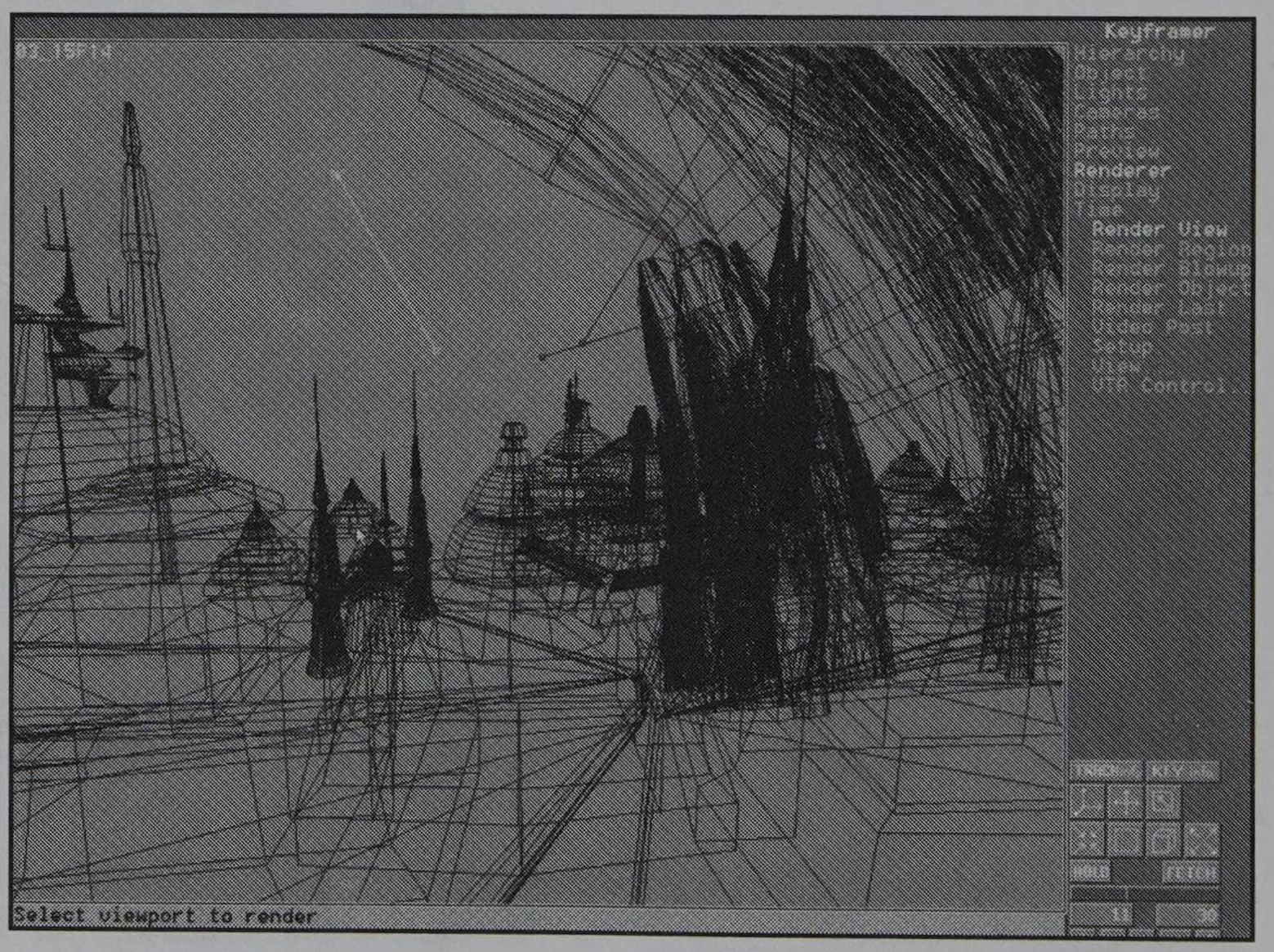
environment, and then there's the animation step — actually having a computer camera fly through the various elements. The cargo cars that are flying around, the guns that are shooting at you, they all have to be animated.

You speak a great deal about the special environment of *Rebel II*. What makes it special? How, for example, is it different from *Dark Forces* which also used modeling as its first step?

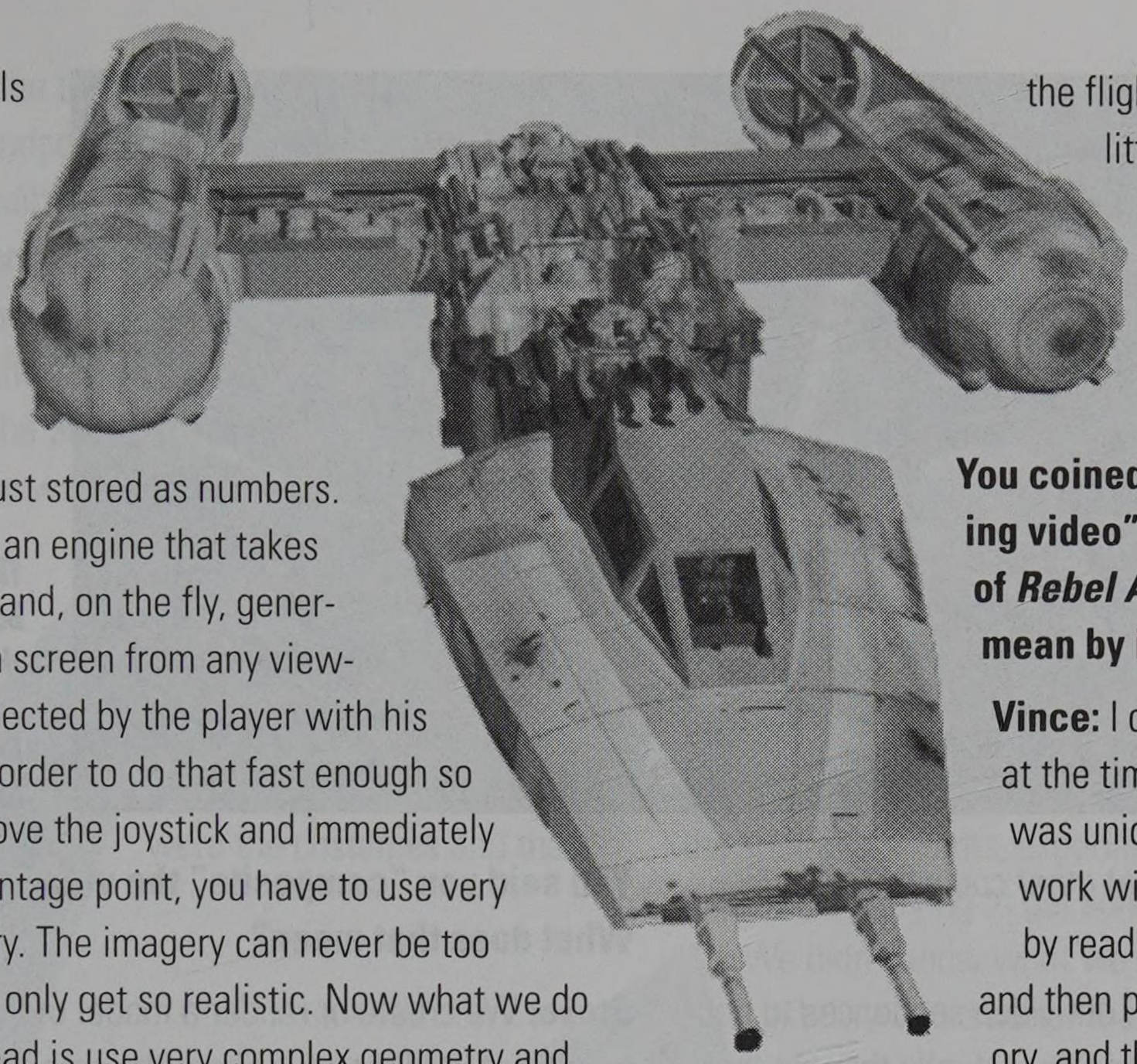
Vince: *Dark Forces* is a much simpler environment because they needed to make an environment that is animated in real time. Once it's modeled, it animates depending on how you move your joystick. So they don't have the animation step, and their modeling step is simpler — it has a simpler geometry. But they make up for the simpler geometry with more complex texturing.

Steve: Because *Rebel II* uses streaming video, it has a much higher level quality of animation than you're going to see in *Dark Forces* and other universal movement games like that.

Vince: The model for the *Dark Forces* environment is stored as a bunch of geometry. You have the imagery for



Artists create a wire-frame background and then establish a flight path.



the actual panels (which are called texture maps), but the model, the geometry, for how these all fit together is just stored as numbers. Now they have an engine that takes these numbers and, on the fly, generates a frame on screen from any viewpoint that is selected by the player with his joystick. But in order to do that fast enough so that you can move the joystick and immediately see the new vantage point, you have to use very simple geometry. The imagery can never be too complex. It can only get so realistic. Now what we do in *Rebel II* instead is use very complex geometry and very complex texture maps to make it look as realistic as we can, and then we generate the imagery, but we predetermine where the camera is going to go.

Steve: The trade-off is that the player doesn't have full control. In *Rebel II*, you can't fly anywhere you like, but the imagery is much more realistic, much more intense. In *Dark Forces*, you can go anywhere you like, but you're going to have a much simpler reality with much simpler animation. The ultimate goal someday is to have the quality of imagery that you see in *Rebel Assault II* with the 3D movement of *Dark Forces*. And the horsepower of the machines is getting there, but it's still a way off.

So the illusion of freedom and control in *Rebel II* is entirely in the shooting?

Vince: Precisely. You can shoot, but your movement is limited. You're limited to moving along a pre-determined path and dodging obstacles that come at you. The game is basically dodging and shooting, at least in the flight sequences. There's a little more freedom in some of the other sequences. And at various points, you are able to choose different paths.

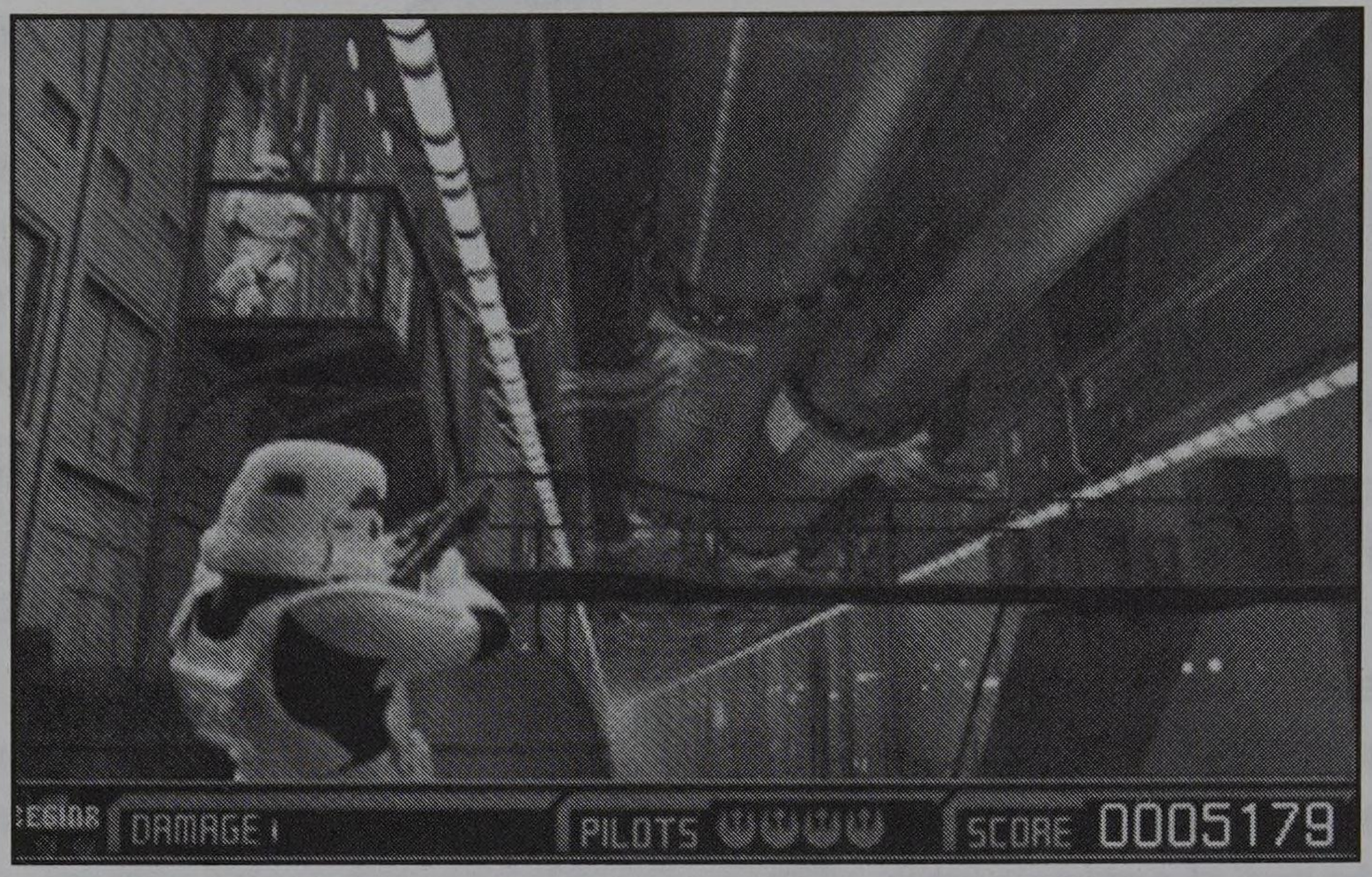
You coined the phrase "streaming video" to describe the look of *Rebel Assault*. What do you mean by it?

Vince: I call it streaming because at the time it was something that was unique. Typically, games work with mass storage devices by reading data off the device and then playing it back from memory, and then you just repeat that cycle. But we wanted something more constant and faster, without the gap in the cycle. Hence, streaming. By streaming, we mean the ability to simultaneously read data and use it at the same time. Instead of going through that cycle, you have part of your code that continually reads data off the disk so that the disk doesn't stop being active, and another part of your code that actually uses the data and animates it as soon as the data comes in.

VIDEO

Shooting live actors is a whole new ballgame for software publishers. Was it hard to pull off?

Steve: We were really stepping into the video arena for the first time, so there was some concern. But the results speak for themselves. From what we've seen from other companies, and from what we know we have in terms of the way things look, it seems like



The actor had to bob up and down in this scene, but there was nothing to hide behind during the blue screen filming.

Rebel II is far ahead of what other companies are showing us.

Vince: I've shown some of our video sequences to people in the video industry and they actually thought that they were from the movies. When we were producing the video footage, we did a test shoot for the opening sequence and we had that footage composited at the end of a tape that showed all the combat footage from all of the *Star Wars* movies. We created it for our production team so that they would know how to light the game sequences and what style to follow. When we asked them what they thought about our composited footage, they said they hadn't seen it yet. "Sure you have," I said. "It was at the end of the tape." They couldn't tell the difference. They thought it was from *Star Wars*.

You said you "composite" the video footage. What does that mean?

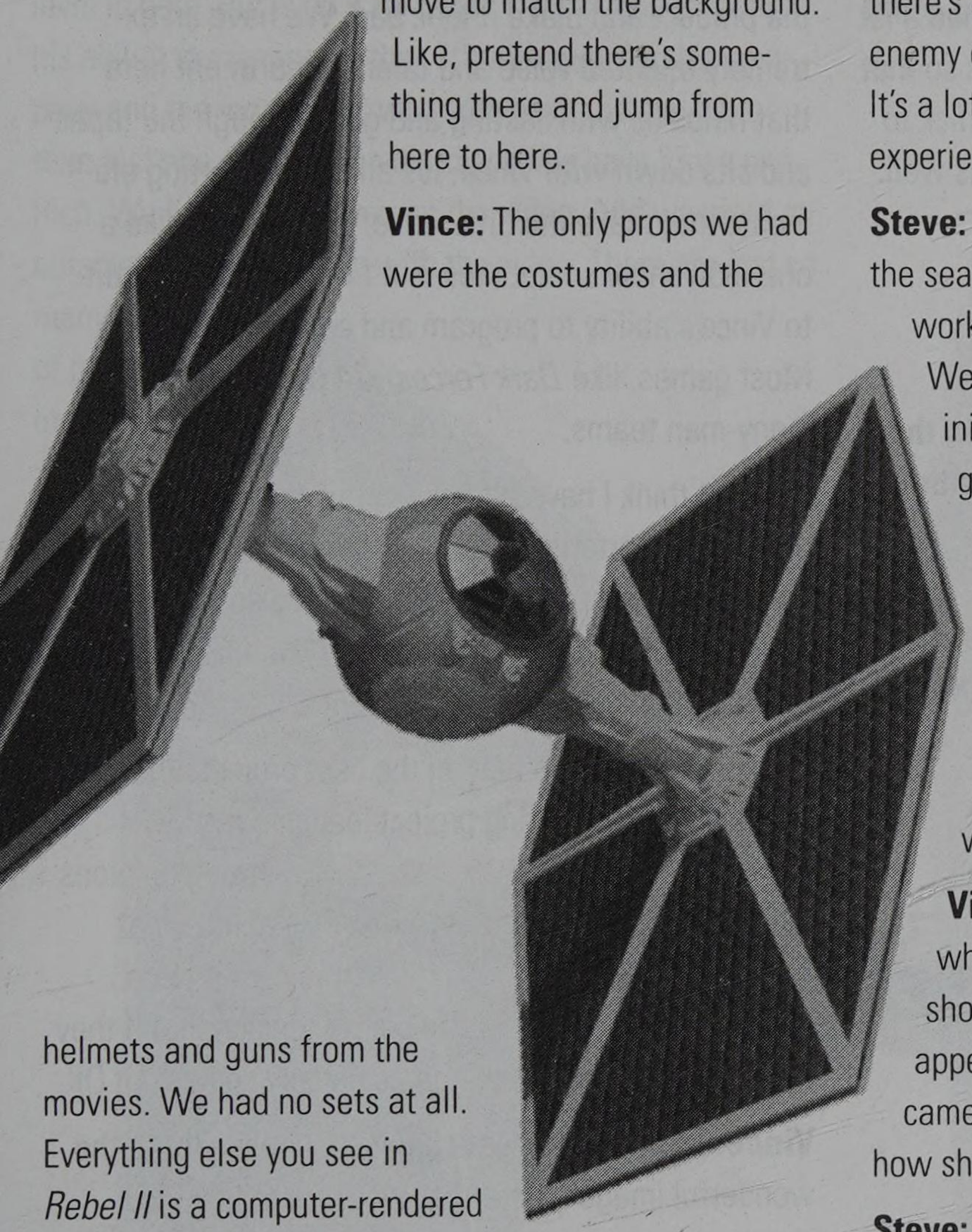
Steve: We create or render a model of a room or an environment, and then we shoot the actor in video against a blue screen background. Then you composite, or match, the video of the actor with the computer model so it looks like a movie. A lot of games go way overboard with video. We only wanted to give quick hits of video and then get you right back into the gameplay. There are no 10-minute video sequences in *Rebel II* that you're forced to watch.

Vince: The tough part is matching the movement in the 3D model with the movement with the actors. Every single shot, every single camera change, had to be meticulously choreographed to get it right.

You have to anticipate where your enemies are going to appear.

Steve: One of the things I'm proud of in this game, from a cost standpoint, is the quality of the video that we got at incredibly low cost. We know that people are spending millions on video and they're not getting the same quality that we do. One of the interesting things we did during the video shoot was bring up a video screen of just the 3D background. Then we would put blue tape on the wall showing the way the actor should move to match the background. Like, pretend there's something there and jump from here to here.

Vince: The only props we had were the costumes and the



helmets and guns from the movies. We had no sets at all. Everything else you see in *Rebel II* is a computer-rendered model.

GAMEPLAY

What's the biggest difference between the gameplay of *Rebel I* and *Rebel II*?

Vince: All the levels of *Rebel II* are much better designed from a gameplay point of view. In the first game, we weren't really sure what would work or what wouldn't, what points of view would work, or what the interaction would be. The gameplay was very basic. TIE fighters came at you and you shot them. That was fine. But the strategy in some of the ground combat levels wasn't really thought out. There isn't much of a timing element involved. But now, in *Rebel II*, there's timing involved. You have to predict when the enemy is going to appear and dodge out of the way when they shoot. And there's more randomization in the TIE fighter levels. The enemy doesn't always come at you in the same pattern. It's a lot of little things that add up to a much richer experience.

Steve: I think that with *Rebel I*, we were designing by the seat of our pants, experimenting with what would work, and trying to get something good out the door. We didn't know what we had, and some levels definitely worked better than others. But from the beginning to end in *Rebel II*, it was like, "We know that this type of gameplay can work." And it also helped that the 3D artists who were creating the worlds would get together with Vince and say you can do this, and fly this way, and you can fly out from behind something and this can come at you. There were more collaborators with more good ideas.

Vince: We have a better feel now. We know what different areas should look like and how they should be lit. For instance, how the terrain should appear when you're flying into an area, where the camera angle should be — close in or pulled back — how sharp turns should be, what looks and feels right.

Steve: Plus, on the gameplay side, the stormtrooper levels are definitely more interesting in this version than in the first game. In the first game, we just thought it would be cool to throw in a stormtrooper level.

Vince: Right. In the first one, I just got the art — and it wasn't in a particularly good state. I ended up spending hours and hours, late nights for weeks, trying to tailor the art, cut and paste it to get something that was even workable. We were trying for an animated

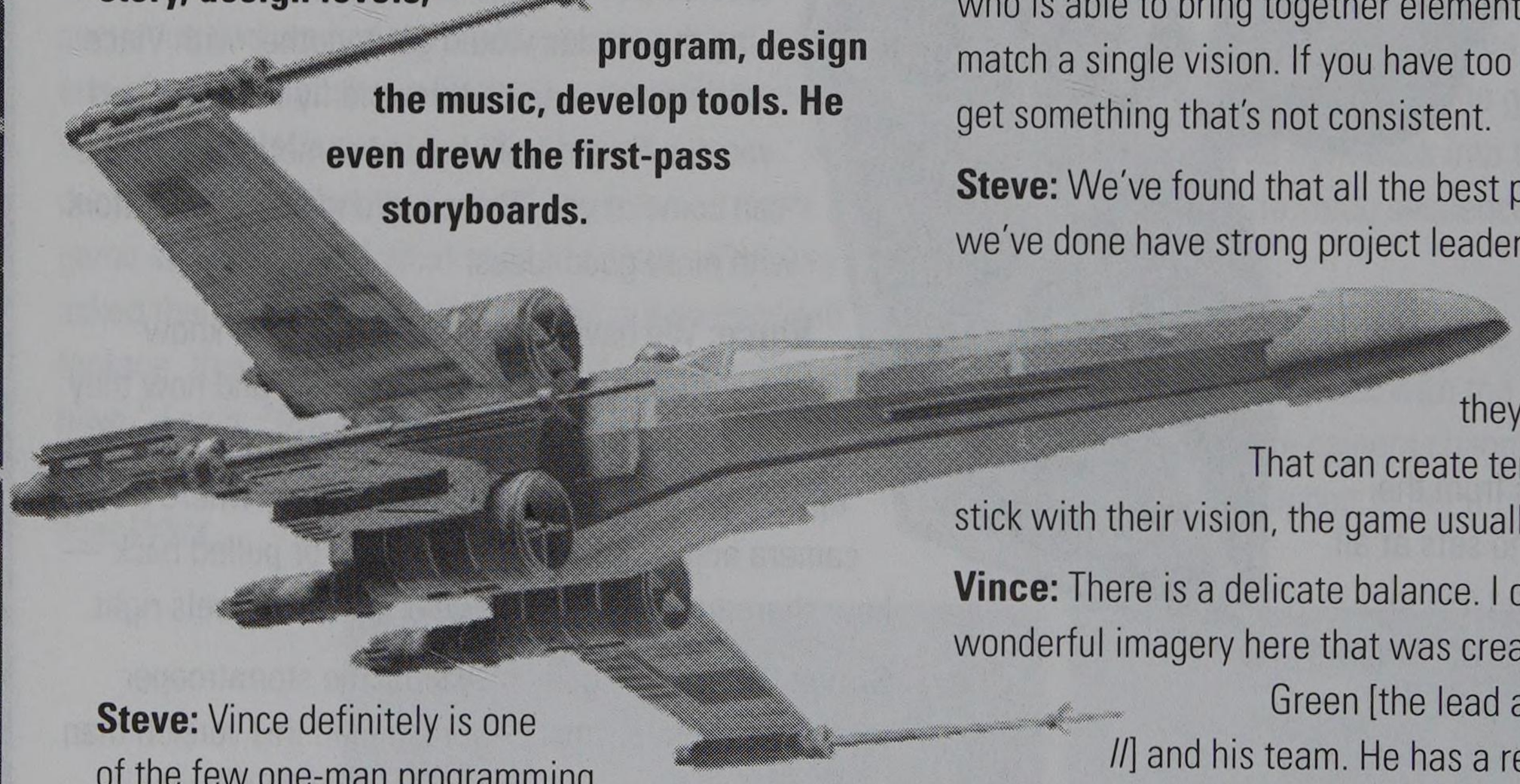
stormtrooper, and to be honest, it works only some of the time.

Steve: But it was the first time that people had ever seen anything like it. Sure, it probably looks a little bit dated now, especially with what you see in *Rebel II*. You do the best you can do.

Vince: Another improvement in *Rebel II* is the mouse control. The mouse never worked very well in *Rebel I*. It wasn't really fun to use. But in this game, I had a lot more time to experiment and tune the controls so that the mouse works much better. I still use a joystick to play, but when I use the mouse, I can fly just as well.

"AUTEUR" GAME DESIGNER?

Vince seems to be one of the few people in the game business these days who does just about everything — write the story, design levels, program, design the music, develop tools. He even drew the first-pass storyboards.



Steve: Vince definitely is one of the few one-man programming shows left. That might work better here than at other companies because we have extremely talented artists and musicians to support him.

Vince: But I know how to ask for help when I need it. For example, I know that I'm not familiar with video, so I relied on Hal Barwood's expertise very heavily. We agreed a lot on the general principles, but I wouldn't dare try to direct actors for the game.

Steve: You can find a lot of game makers who want to be film makers, and so they'll say that they can direct as well. But you see the quality suffer. If we didn't have Hal here, we would have gone out and sought another professional director to do this. Especially with *Star Wars*, you don't want to cheapen the product and make it look bad. We have an extremely talented voice and talent department here that helps us with casting and goes through the tapes and sits down with Vince. It's all the supporting elements that make the difference. It may seem like a one-man show sometimes, but I think that's a credit to Vince's ability to program and create this engine. Most games, like *Dark Forces,* are programmed by many-man teams.

Vince: I think I have a good overall sense of things. I think it's important to have one person on a project who is able to bring together elements so that they match a single vision. If you have too many cooks, you get something that's not consistent.

Steve: We've found that all the best projects that we've done have strong project leaders who have strong opinions about what they want to do. That can create tension, but if they stick with their vision, the game usually comes out OK.

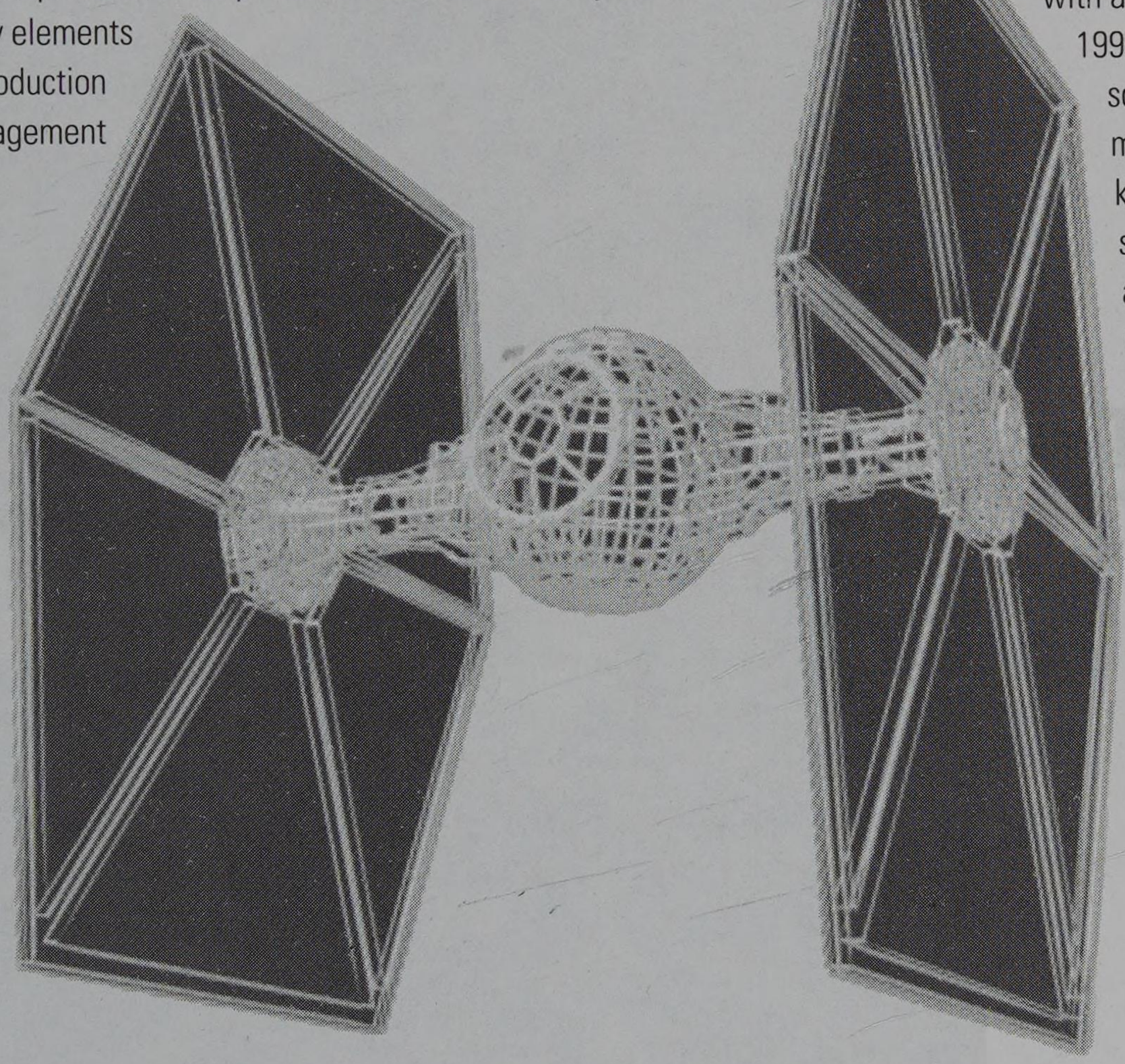
Vince: There is a delicate balance. I owe a lot to the wonderful imagery here that was created by Rich Green [the lead artist on *Rebel II*] and his team. He has a really good vision and is a great artist. For me, the fact that *Rebel II* is so much larger a project than *Rebel I* makes it harder to maintain that delicate balance of getting what I want and yet respecting the need for others to create as well. So basically I outline what I want and then give them the freedom to work within those large boundaries.

Steve: When Rich first came onto this project, he really wanted to do a lot of the artwork. But because he's the lead artist now and he's managing a much larger group than worked on *Rebel I* — or any project — his actual contribution of sitting down and drawing or animating a level has probably been a lot less than he would want. I know it's a real tough balance for him. And one of the things that he's been holding onto is: I've got to get a level in here. But even if he doesn't, his stamp is really his ability to manage all that. It's a change for this company and the industry as well. You have to have more than just one manager on a project. We have Vince and Rich. We have Hal to oversee the video. And we hired an outside producer to help with the video. There are just so many elements of production management now. You could fly by the seat of your pants before because, frankly, the budgets weren't million-dollar budgets and the expectations weren't as large.

THE FUTURE

George Lucas is in the process of writing and developing the next *Star Wars* "prequels." Has there been any discussion about games based upon these new works?

Steve: We don't even know what they will be yet. In 1997, they're going to do the rerelease of the first movie with added footage. I think that 1998 is what is currently scheduled for the next new movie — but you never know. From a game perspective, that's not far away. With an 18-to-24-month development cycle, we'll be starting planning by next year.



CHAPTER 5

TELL ME A STORY (WITH TECHNOLOGY)

Tell Me a Story (with Technology)

To create any dramatic story, regardless of the genre, writers concentrate on the makeup of their characters, how these individuals interact, and how they change or grow during the course of the story's action. In this sense, stories for interactive games such as Rebel Assault II *are not really dramatic stories. Instead of creating "fire" between characters and concentrating on character development, the authors of computer games are trying to create an interesting plot to frame the gameplay. They are also trying to spark emotional, visceral reactions within players by inserting them into "real" circumstances and consequences — which players can control and influence.*

Control of the action, then, is what separates a computer game from traditional dramatic mediums. Other names for it are gameplay and player interface. Whatever you call it, it is this concept of control or gameplay that dominates every phase of a game's design — including the writing of the story. If writing a movie is all about telling a story of a character with pictures, then authoring a computer game is all about telling a story of the player's experiences with technology. In books, movies, TV shows, and stage plays, there is rarely, if ever, a need to talk about the technology of the experience. You experience them directly, unaware of "how" it is being brought to you. But in a game, you're in control. You actually bring the experience to yourself. And to do that, the technology of "how" becomes paramount. Hence, story proposals often skimp on plot twists and focus on the new wonders improved technology can deliver.

This chapter describes how Vince Lee, with a little help from his LucasArts friends, created the story for *Rebel Assault II*. As you will see, it started way back in April 1992 when Lee submitted his original product design document for *Rebel Assault*.

WHAT DO YOU PROPOSE?

At LucasArts, as at most software development companies, the game creation starts with a design document. Significantly, it is not called a screenplay or a game story. The design document most certainly describes the story idea for the game, but story is rarely the shank of the offering. What the money people want to know, what the sales force wants to know, what the development people want to know, what the computer artists want to know, what everyone wants to know is: "What's new?" Can you name a truly great character in a computer game? Is there a truly compelling story in a game that in itself puts you on the edge of your seat? Maybe you can, maybe there is. But even so, it's always the new technology design that separates the shuttles from the booster rockets. Are the graphics cooler? Is the sound hotter? Is the action more real, immediate, intense?

In this regard, the design document for *Rebel Assault* (which had a working title of *Star Wars CD*) reads more like the specs of a hot new sports car than a movie screenplay. You can keep your characters and

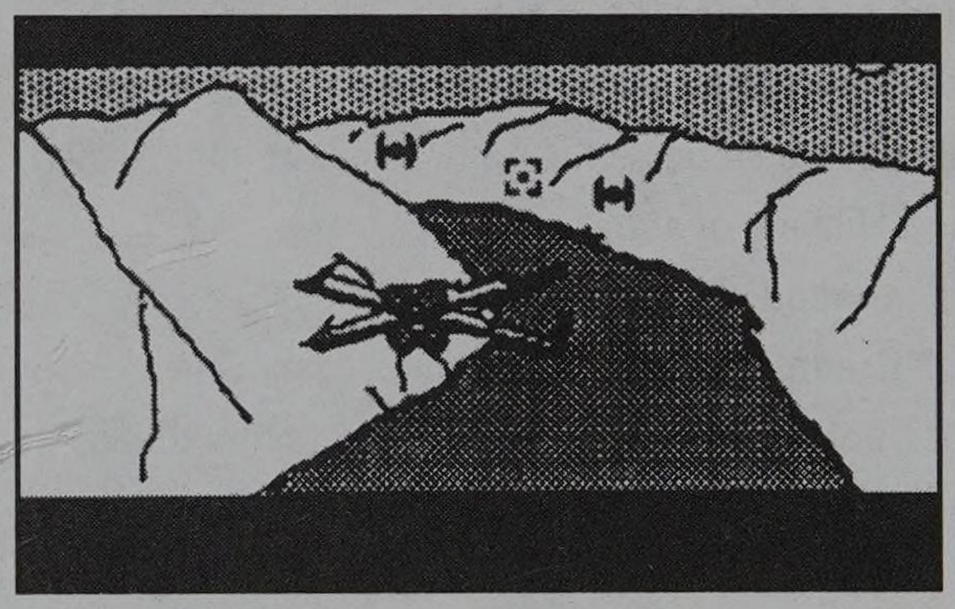
plot points; what's under the hood? Lee describes the "engine" in his original design proposal and, although it is significantly souped up, it's the same basic engine for *Rebel Assault II*.

> *Star Wars CD* is a visually-oriented flight-combat game for CD-ROM-based game platforms. Aspects of its design resemble both PC-based simulators (*X-Wing*) and cartridge-based arcade games (*Super Star Wars*). However, *Star Wars CD* is neither a true simulator nor a conventional arcade game. Instead, it exploits the massive storage capacities of CD-ROM to provide interactive gameplay in a world of realistic imagery and animation. These graphics are 3D-modeled and pre-generated on computer, complete with cinematic cuts, camera angles, pans, and zooms. The emphasis of the game is on stunning imagery and animation and not strategy or complex game play.

At this point, four pages into the 16-page proposal, Lee introduces the game's first story elements. But he does so only in order to flush out the mechanical details of the gameplay. Once you know who you are and what you are supposed to do, it's back to the action mechanics. It's interesting to see how the limitations of the current technology determine the range of the game's action as well as its story.

> **Scenario** *Star Wars CD* has 15 game levels which play linearly from beginning to end. Each level will contain approximately one minute of animation. These are divided into four "acts": Training (3 levels), Tatooine (3 levels), Hoth (4 levels), and Yavin (5 levels). Play can begin starting on any level using a passcode entry system. In addition, each act will also have gratuitous fancy cinematic lead-ins (following in ships from space, etc.).
>
> The game is based in the *Star Wars* universe but does not limit itself to elements mention in the motion pictures. In addition, although the game's story coincides somewhat with the storyline of *Star Wars*, we see the action from another point of view, not that of Han, Luke, Chewie, or the Princess. Instead, the player is a rookie Rebel pilot, who gains rank and experience as he/she participates in both training and actual missions against Imperial forces, climaxing with an attack on the Death Star station.

> **Game Mechanics** The gameplay of each level consists of one or more segments following three basic models.
>
> - **Constrained Flight** In constrained flight, the player navigates an air or space vehicle through pregenerated terrain or obstacles. Since the scenery in our flight sequences is calculated beforehand, so must be the craft's flight path. We can create some interactivity using branching and stream manipulation, but the player's control of his/her vehicle cannot be as unlimited as with a true flight simulator. Thus, in a constrained-flight sequence, there must be a rationale for the player's inability to freely navigate. In most levels, this will take the form of flight in a canyon or trench (where path deviation would cause the player to strike the canyon walls) or pursuit of another vehicle, where the direction of travel is obvious.
>
> The player will fly his/her vehicle, viewing it from behind, superimposed over a moving background image. The vehicle can fall, climb, bank left or right, but if it moves too far to the side, it will hit the side of the trench or canyon, causing an explosion and loss of a shield unit.

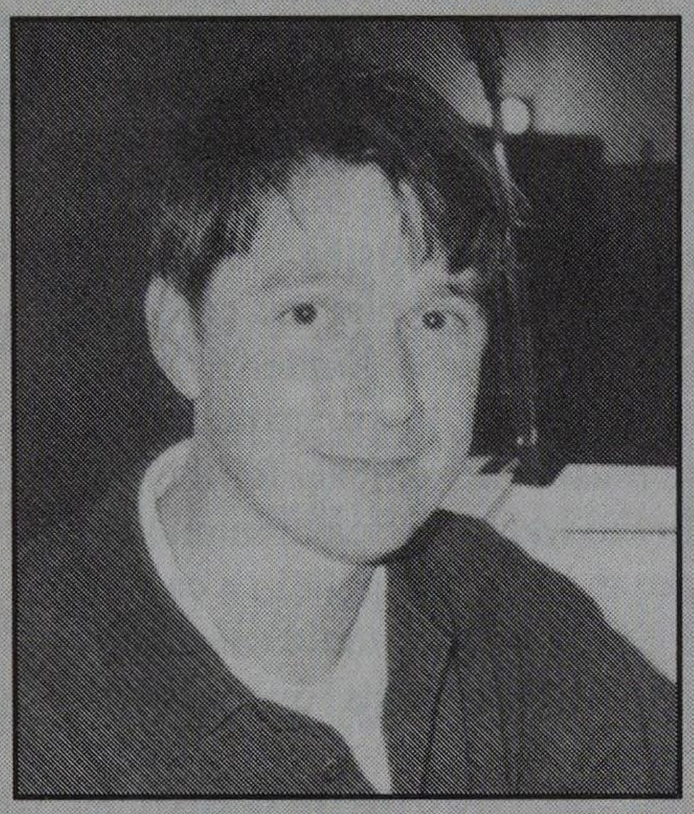


> In some levels, there will be targets to shoot. When this is true, a targeting sight will appear in front of the player's craft.
>
> - **Forward Shooting** In forward shooting, the player's path is completely pre-determined. Thus, the player assumes the role of gunner only. However, since the flight path need not appear interactive, it can be made unusually complex and interesting.

REBEL PROFILE

PAUL TOPOLOS

Storyboard Artist

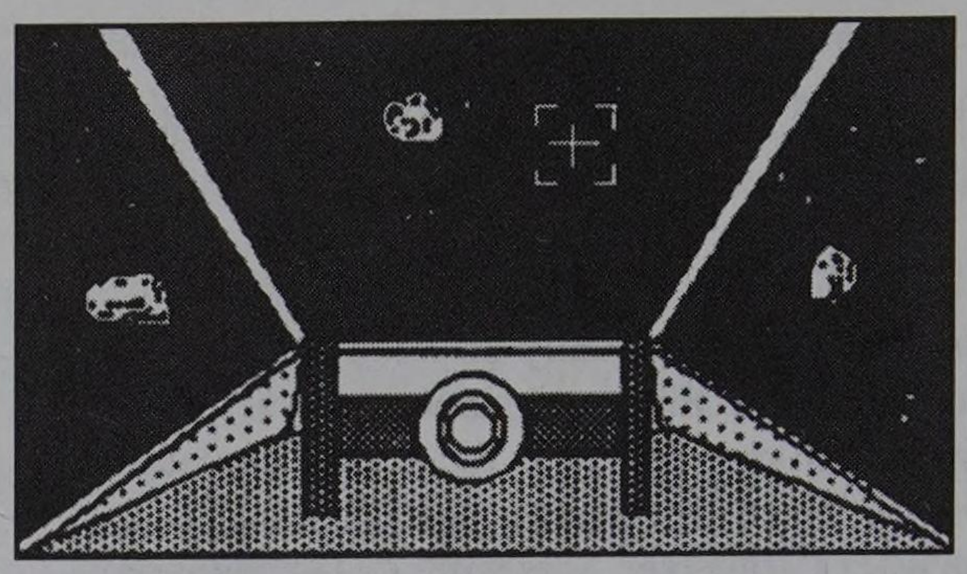


Paul Topolos

Just about every piece of art that went into *Rebel Assault II* was created on computer, but there's one vital step in the video process — storyboarding — that's still best done with an old fashioned pencil and sketch pad. Designer Vince Lee drew the first rough set of boards to flesh out the storyline, but Video Director Hal Barwood required a more detailed set to serve as the camera blueprints for the actual filming of actors.

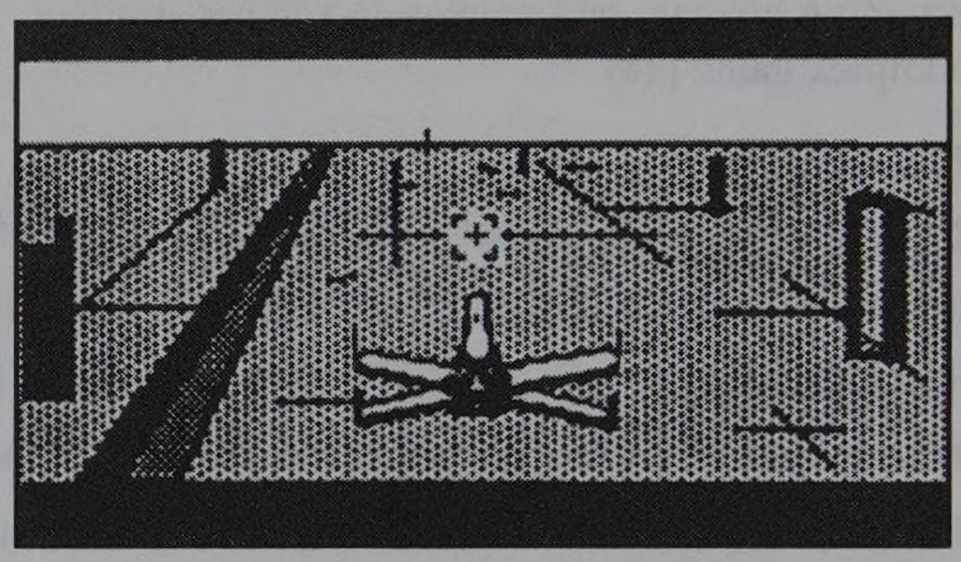
Barwood, Project Leader Vince Lee, Lead Artist Rich Green, and Video Technician Mark Christiansen met frequently over a period of several months to fine-tune the storyboards. The major goal was to create transition cut scenes that were engaging, understandable, and affordable. To help them in this streamlining, they engaged Paul Topolos, a professional illustrator and movie storyboard artist. The group would decide on the specific shots and the camera angles for each sequence, and Topolos would go off and draw them on his sketchpad. "We worked very hard with Hal to make every sequence make sense," Topolos said, "and to tell a story as interestingly and economically as we could."

The speeder bike scene before Chapter 10 is a good example of how the storyboarding process can add drama while still reducing costs. "Originally," Topolos said, "there were to be cuts back and forth



The display is from a perspective inside the cockpit, not outside the craft. A target sight exists for aiming at objects to shoot.

- **Surface Bombing** In surface bombing, the vehicle attacks land targets passing below the player's vehicle.

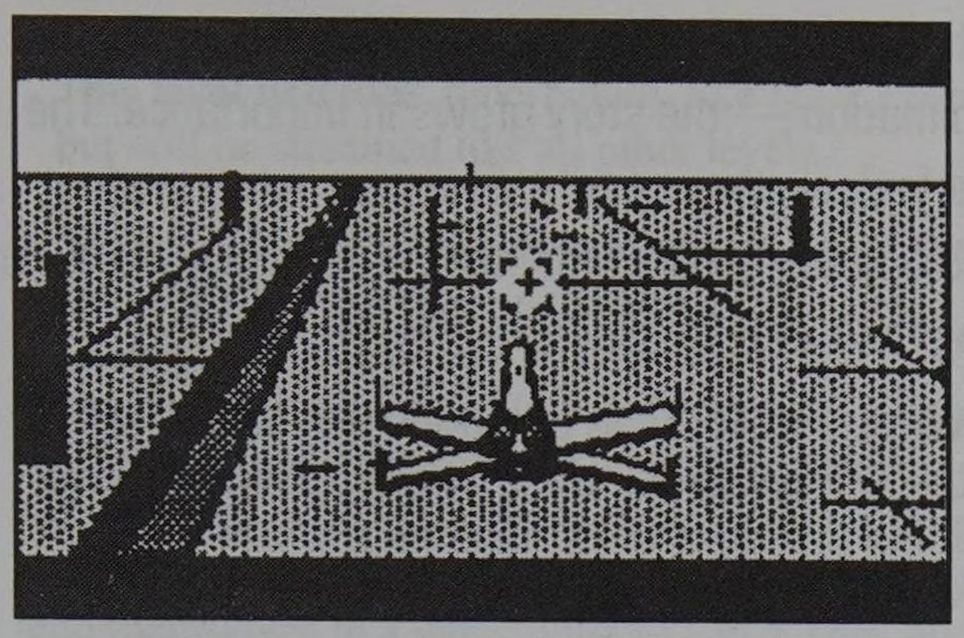


The displayed perspective is from behind and above the player's craft, which is a series of sprite images in memory, overlaid over streaming animation. The vehicle is controlled the same as in constrained flight with a bombing sight for launching proton torpedoes as targets.

The final portion of the original proposal for *Rebel Assault* is a synopsis of the 15 levels. The storyline for each level is, again, more concerned with action development than character development. For sake of brevity, only two levels (the final two levels) are repeated here.

Level 14: Death Star Surface Attack

Storyline Clearing away for a trench assault on the Death Star, Rebel X-wing shoots towers and structures on the Death Star surface and bomb gun and antenna emplacements.



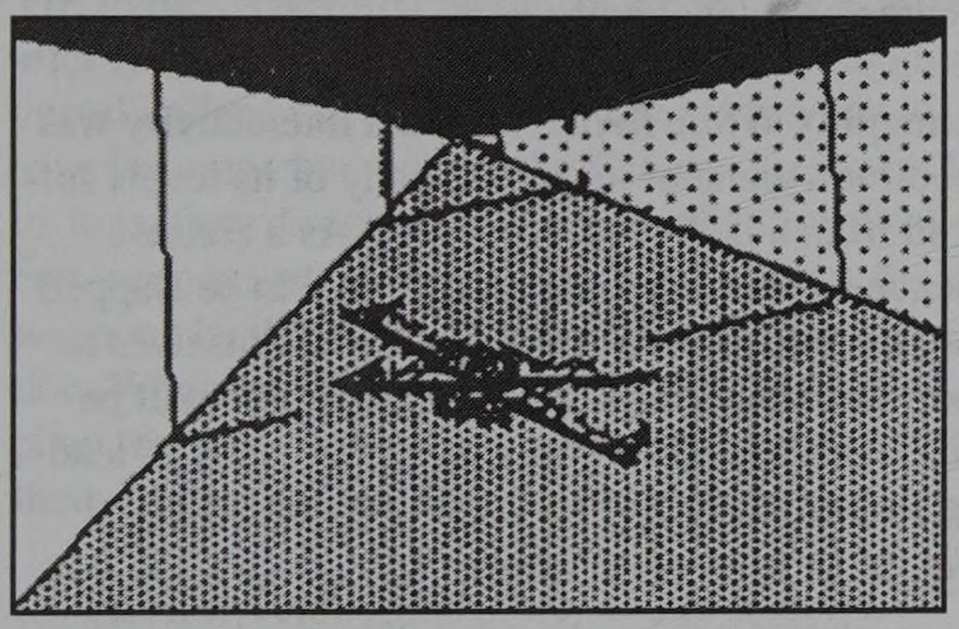
Gameplay

1) Shoot towers and avoid their shots. (Surface Bombing)

2) Destroy turbo laser gun surrounded by TIE fighters. (Forward Shooting)

Level 15: Death Star Trench Attack

Storyline The player serves a support role in the primary trench attack on the station. He/she follows a lead X-wing into the trench. The player's assignment is to shoot surface guns and any TIE fighters that descend into the trench behind the lead X-wing. The lead pilot will, of course, miss, and the player will have to shoot the exhaust vent. If successful, there will be a really neat explosion animation.



Gameplay

1) Shoot gun ports on trench walls. Avoid protrusions from trench side and plasma bolts. (Constrained Flight with shooting)

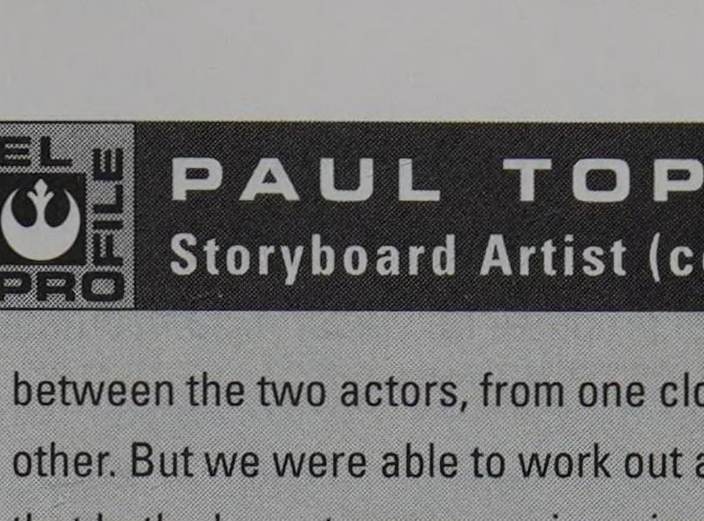
2) Shoot TIE fighters descending into the trench flying either towards the player or toward the lead craft

3) Shoot the exhaust vent. (Bombing)

REBEL PROFILE

PAUL TOPOLOS
Storyboard Artist (continued)

between the two actors, from one close-up to another. But we were able to work out an approach so that both characters appear in a single shot. It's simpler and more dramatic, with a real sense of speed and movement — yet we cut down on the number of shots."



Some of Topolos' favorite storyboards

The "sketch to storyboard to game screen" sequences for the speeder bike segment of *Rebel II* appears later in this chapter.

Topolos, 28, is a contract artist with LucasArts who works on different projects on an on-again, off-again basis. *Rebel Assault II* was his first storyboarding job for a game company (although there have been others since), and he continues to work in the movie industry with colleague Iain McCaig *(Hook, Interview With a Vampire),* one of the most

What Have You Done For Me Lately?: The Proposal for *Rebel Assault II*

Because the original proposal for *Rebel Assault* created the engine and action structure for this type of game, Vince Lee's proposal for the sequel focused on embellishing that structure instead of redesigning it. But the million-dollar question was still, "What's new?" At first, Lee didn't think he could bring anything new to the game, and so he turned his mind to other projects. But when it became clear that the target computer for the sequel would be a 486 computer with a double-speed CD-ROM, visions of technological sugar plums began to dance in his head. Because Lee believes that in computer games "the game is more important than the story" he started the design process by brainstorming what a player negotiating *Rebel Assault II* would do.

"I asked for a lot of ideas from people around the company," Lee recalls. "But what was really the impetus for the story were different gameplay levels that we wanted to put in. Michael Stemmle, one of the other project leaders, and I stayed here a couple of nights and wrote down what kind of levels and what kind of action we wanted to have as far as gameplay goes — TIE fighter levels, behind-ship flying levels, on-the-ground-shooting-stormtrooper levels — similar levels as in the first game but with lots of new ones as well. Once we had the action of the 15 levels spaced out, we sketched out a story that would thematically connect all of the levels."

THE REBEL ASSAULT II DESIGN PROPOSAL

The ensuing proposal for *Rebel Assault II*, reproduced here, clearly shows the Lee and LucasArts bias for action technology over storyline drama. Or as executive producer Steve Dauterman puts it: "Around here, we've always focused first on 'what are you going to do' before the story and the dialogue." But it's interesting to note that once they have answered the "What's new?" question — hey, let's meld live-action video with our 3D animation — the story grows in importance. The technological advance into video was what made it possible to flush out a story that is definitely more compelling than *Rebel Assault.*

Overview *Rebel II*, as proposed, will be a 15-level CD-ROM arcade game very similar to its predecessor. It will, however, incorporate significant improvements in technology, gameplay, and story.

Technology Improvements to the *Rebel Assault* engine will provide the following technological advances:

- New tiling compression allowing 256-color, full screen, fully-moving imagery.
- Smoothed sprites allowing overlaid spaceships and explosions to blend smoothly into the background.
- Stereo sound which pans to match imagery on screen.
- Live video to enhance the movie-like quality of the game.
- A true save game feature which saves the last completed level with score.

Gameplay While *Rebel Assault*'s interactivity was good for a game of its genre, many of its levels suffered from a lack of pre-planning. As a consequence, some of the interactivity had to be slapped onto animations which did not lend themselves to good game play. This time around, levels will be thoroughly designed with game play in mind, leading, in part, to the following improvements.

- Stormtrooper levels will require more strategy to complete. Each encounter will have places where the player can avoid shots from certain enemies (hiding spots), special targets to shoot (door locks, power junctions, etc.) and time limits (approaching enforcements, overloading equipment, etc.).
- There will be no top-view bombing levels, as they were awkward to play.
- There will be some minor inter-level interactions. For instance, if you destroy more TIE fighters in a hangar on one level, fewer will come after you in the next.

- There will be one first-person stormtrooper level. This level will look superficially like *Dark Forces*, but will be streamed like all other levels.
- You can fly new ships, including speeder bikes and a *Millennium Falcon*-class ship.

Story *Rebel Assault* followed the story line of *Star Wars* with some elements of *The Empire Strikes Back* thrown in. *Rebel II* will be more of an original story, as the plots of *Jedi* and *Empire* do not easily lend themselves to a game without Luke, Han, and Leia. Some elements, such as speeder bikes, will be included. There are, of course, Ewoks, but I prefer to save them for a game where they can be used in a blaster-absorbing capacity.

Rebel II takes place after *Star Wars*, and centers on the Empire's newest development in the Rebel/Empire arms race. They've developed a new TIE fighter which can render itself invisible to the sensors of other spacecraft. This "cloaking" ability had previously been available only on very large vessels. But now, having adopted the technology to small-scale craft, the Empire has been building a fleet of such vessels. Once deployed, they would pose a major threat to Rebel forces, who would have no warning of their approach.

Initially, the Rebels are unaware of the cloaking TIE fighter. They first learn that something is afoot after responding to a distress call from a smuggling vessel under Imperial attack. They are too late to save the crew, but recover the *Falcon*-class ship. In its logs, they discover the location of an Imperial secret weapons program. They decide to attack the weapons facility, still unaware of its precise function. When Rebel squadrons reach the Imperial plant, they encounter the cloaking TIEs and report their existence to the Rebel Command.

Admiral Ackbar and the Rebel Command devise a bold plan to counter the newly-found Imperial threat. They decide to send two Rebel agents into an Imperial stronghold to steal one of the cloaking TIE fighters and return it to Rebel forces. It is hoped that the craft can be studied and a way found to counteract its cloaking ability.

FROM PROPOSAL TO STORYBOARD

After Vince Lee and company had determined what a player would do in the 15 new levels of *Rebel Assault II* (a process that consumed a couple of weeks), it was time to connect the action dots. "Once

REBEL PROFILE

PAUL TOPOLOS
Storyboard Artist (continued)

Topolos concentrated on facial expressions during storyboarding.

preeminent storyboard artists in the world — and a former employee at LucasArts. Recently, the two have been working on the upcoming film *Dinotopia*, which is based on the best-selling book by artist James Gurney.

Topolos studied traditional illustration, specifically fine art portraiture, from the Academy of Art College in San Francisco to the American Institute for Foreign Study in London to the University of California, Santa Cruz to the University of Leeds, England. When he returned to the United States, a friend introduced him to McCaig, and so began his storyboarding career. "Iain explores how to tell stories through pictures," Topolos says. "Instead of spelling things out with dialog, we try to show it. If somebody is walking down a street, for example,

The storyboard and game screen

REBEL PROFILE — PAUL TOPOLOS
Storyboard Artist (continued)

how could you show visually without uttering a word that he's thinking of stealing something? There are a lot of techniques you can use — different angles, how closely you crop a shot."

Storyboarding for computer games or movies is similar, Topolos says. "I didn't even get a computer until last week, so it really doesn't have anything to do with the computer. The aspect ratio of a wide screen in movies is a lot different than a small computer screen, and the stories you tell in games are a lot shorter, but the process is the same."

Because faces and facial expressions are so important in conveying the emotion of a video scene, Topolos's portraiture background comes in handy. At the start of the project, he asked Lee for a list of famous actors he'd most like to play the characters in *Rebel Assault II*. Armed with this information, Topolos would take stills from movies and draw these characters into his storyboards. The final actors, of course, looked nothing like their famous inspirations, but they helped the team get the right feeling and cast the right actor for each scene.

For the cockpit shots, Topolos took a friend — "a model who looks Tom Cruise-ish" — to the Lucasfilm archives where he photographed him

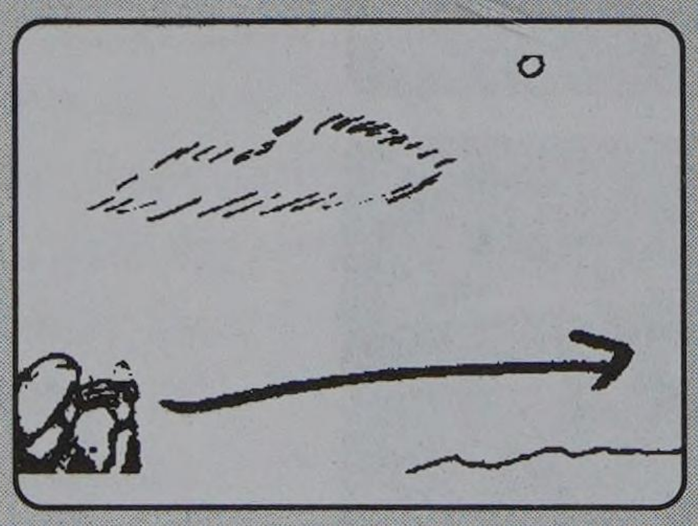
the actual levels were set and we knew what was going to happen," Lee says, "it was pretty obvious what needed to happen storywise. It was just a matter of writing a script around the action, and that took about six months."

The script Lee created looks more like a movie storyboard than a movie screenplay. Again, that's due to the game's emphasis on action over character development. Enhanced, live-action video might allow enhanced storytelling, but the *Rebel Assault* design team wasn't about to go Hollywood or even as far into video as some game companies have gone.

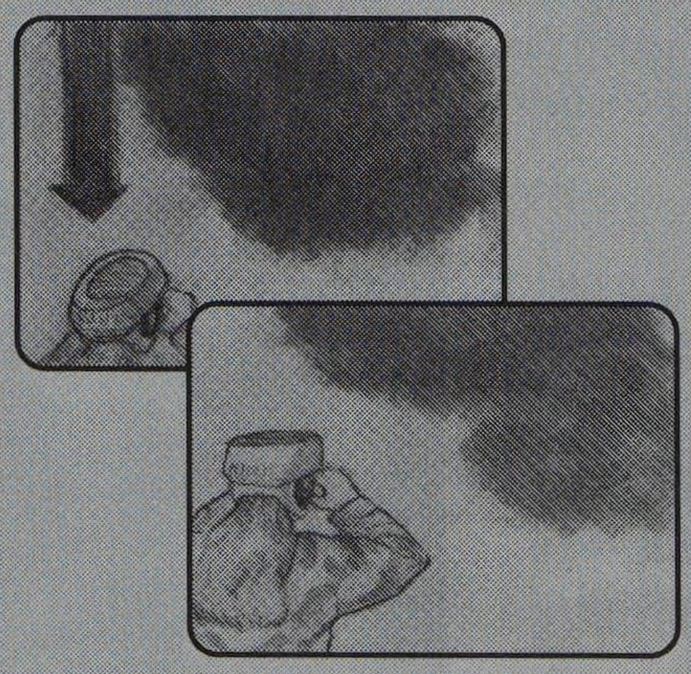
"People are more interested in being put into an environment to play a game than they are in sitting back and watching a story," Lee says. "I think that's a mistake a lot of game makers make — they think people want to watch other people talk on screen and interact. We have the shortest scenes possible to explain the action, and our goal was to make them feel like the *Star Wars* movies, true to what people expect."

Executive producer Dauterman concurs: "Television, movies, and video can do drama much better than we can. They have much bigger budgets to tell a really good story. In a game, we have to concentrate on the experience. People can turn on the TV if they want to watch a good movie. When they turn on the computer, they want to make things happen."

FROM STORYBOARD TO GAME SCREEN



Lee's sketch



Topolos' storyboards

Game screen

So Lee took out his sketch pad and sketched each scene, frame by frame, envisioning what the new game would look and feel like to the player every moment as it was being played. "I'm a big science fiction fan," he says, "so the story borrows a lot of elements from science-fiction movies and series from TV. Some things that were only hinted at in the *Star Wars* films we wanted to see. The story carries on the general theme of Darth Vader wanting to do whatever he can to destroy the Rebels. In that way, it's a very *Star Wars*-like story. Darth Vader has come up with some new, powerful weapon — in this case cloaking TIE fighters — to destroy the Alliance. The story weaves it's way around that as the Alliance tries to figure out what this new doomsday weapon is and how to destroy it. At the end of the game, you have to go in and capture one of the cloaking TIE fighters to take back to the Alliance. At first, you don't know what the weapon is, and the Imperial fleet just starts to suddenly disappear. From there the story builds, level by level, as you try to find out what's going on and how to defeat the weapon."

After an introductory sequence, which hints at the existence of the Empire's newest secret superweapon, the structure of Lee's storyboard follows an identical pattern: A short live-action video sequence that explains the upcoming circumstances and challenge of each level followed by the "path" of the player's action (called the

REBEL PROFILE

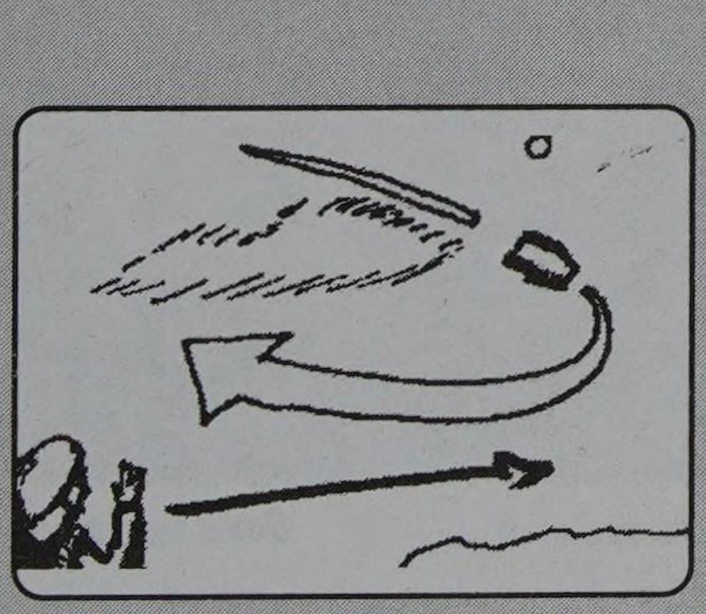
PAUL TOPOLOS
Storyboard Artist (continued)

sporting different Star Wars helmets. For illustrations of ships, he went shopping. "I'd buy little Star Wars models, put them on a stand, and draw them," he said. For some close-up expressions, he would use a mirror and draw himself. As he puts it: "You do whatever you can do to capture the feeling of the scene."

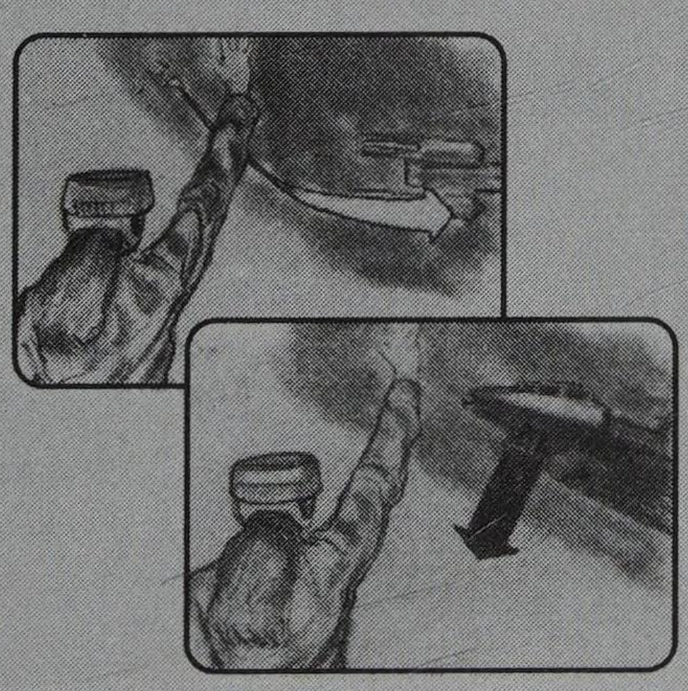
Storyboarding can be a time-consuming process. The Industrial Light & Magic standard, according to Topolos, is 10 pictures a day in a 10 hour day. "I was doing between 13 and 15 in an 8-hour day," he said, and he drew several hundred boards. At first he was too painstaking in his art. "This was one of my first big jobs, so I spent a lot of time proving myself, and I kind of went overboard. You can see the difference between the ones I spent a lot time on and the ones when we got to the point where it was 'We need them now.'"

Some fine artists might raise their noses at the idea of drawing space ships for computer games, but not Topolos. "I love the *Star Wars* stuff. It's one of my favorite movies of all time and it's kind of bizarre fate that I'm drawing X-wings for a living. All the artists around here care so much about their work, and it's such high quality, that I'm proud to work here. It all comes down to storytelling."

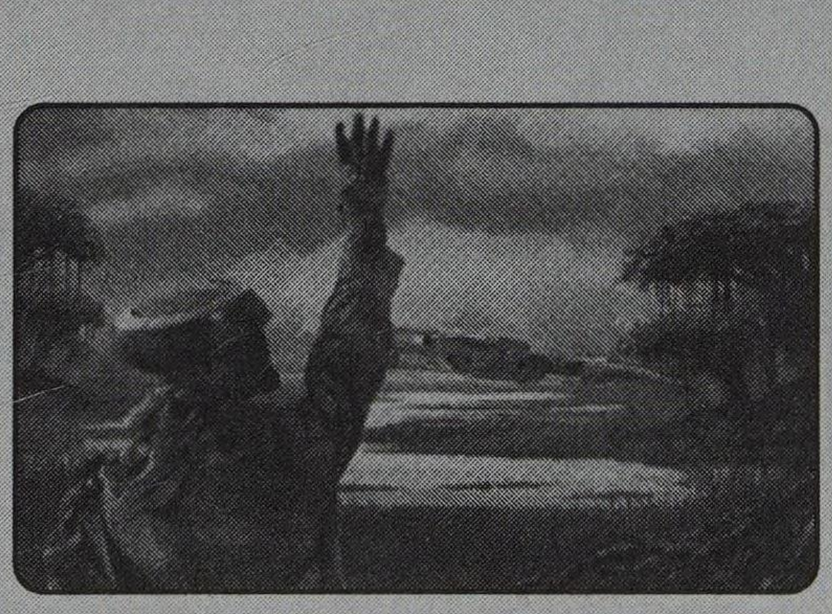
FROM STORYBOARD TO GAME SCREEN



Lee's sketch



Topolos' storyboards



Game screen

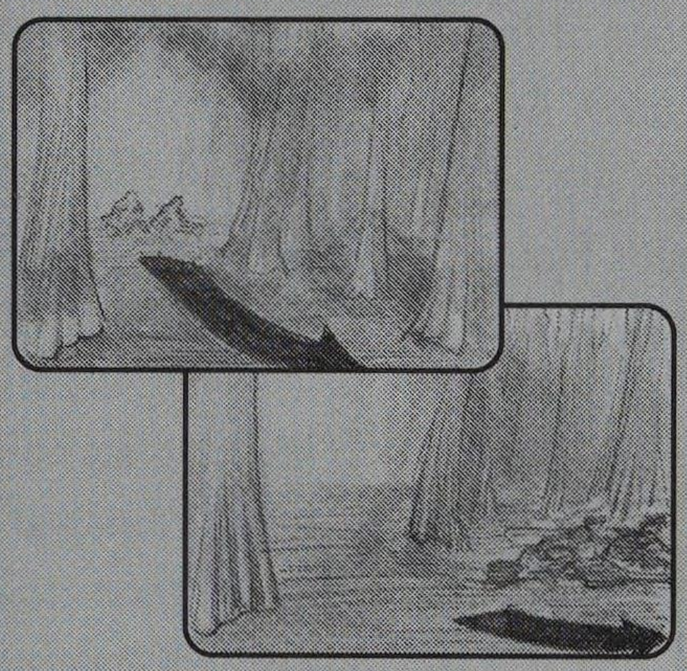
playable section) followed by another live-action video sequence that transitions the player to the next level. Sometimes there is also an extended video sequence, called a "cut scene," between levels. They gradually reveal more and more of the mystery. When all 15 levels have been conquered, the player is treated to a final victory sequence and the game ends. To illustrate how Lee sketches out a level, I've reproduced here his original storyboards for Level 6 and the cut scene that precedes Level 7.

FROM FIRST STORYBOARD TO SHOOTING SCRIPT

Vince Lee is a successful game designer, an expert programmer, and as his storyboards show, an adequate storyboard artist. But what he is not, as he freely admits, is an experienced movie director. As a result, his storyboards were useful in showing the flow of the game but inadequate for the process of actually shooting the video sequences. Fortunately, Lee had all the

FROM STORYBOARD TO GAME SCREEN

Lee's sketch

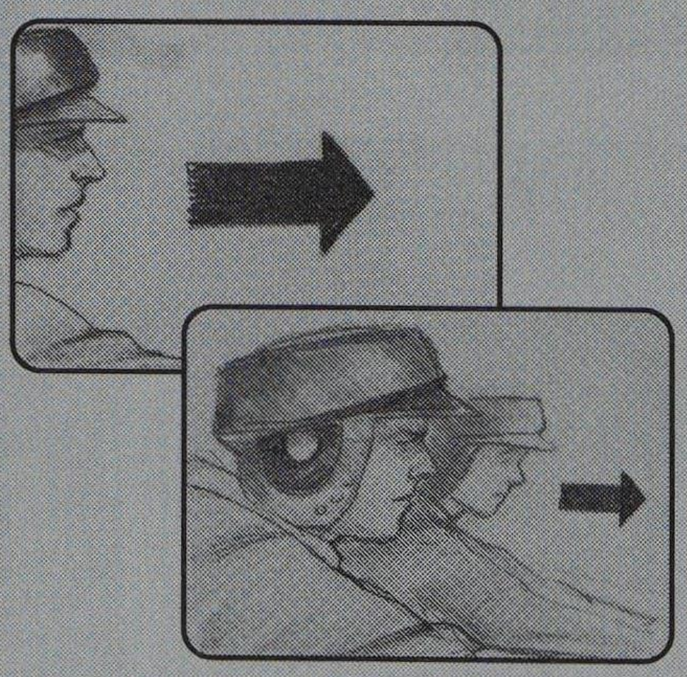


Topolos' storyboards

Game screen

FROM STORYBOARD TO GAME SCREEN

Lee's sketch



Topolos' storyboards

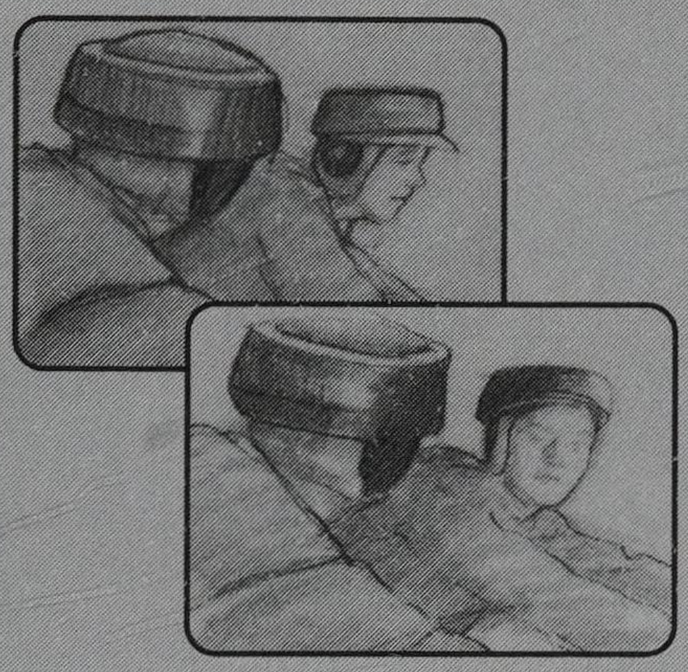
Game screen

movie-director experience he needed just a few doors down the hall at LucasArts.

"Although I'm a writer, I didn't write any of the script," says Hal Barwood, who like Lee is a project leader at LucasArts as well as a 20-year veteran of Hollywood screenwriting, directing, and producing. He would fill in the missing link between what the video sequences in *Rebel Assault II* might look like (as seen in Lee's boards) and what they had to look like for maximum realism and, yes, dramatic effect. "My involvement took another form. Vince in his doing his script did a lot of storyboards, and they're very valuable from the point of view of doing shot counting. They would be enough to say, 'Well, this is going to take four shots to get this done.' Superficially, Vince's originals look pretty interesting, but it turns out that there were two problems with them. One is that they aren't really what I think of as storyboards. Storyboards convey not only the pictorial information that's present onscreen at any given moment, but where the camera is in relations to that. What's going on the camera here? Are we low, are we high, are we moving left to right, what's the action

FROM STORYBOARD TO GAME SCREEN

Lee's sketch



Topolos' storyboards

Game screen

FROM STORYBOARD TO GAME SCREEN

Lee's sketch

Topolos' storyboard

Game screen

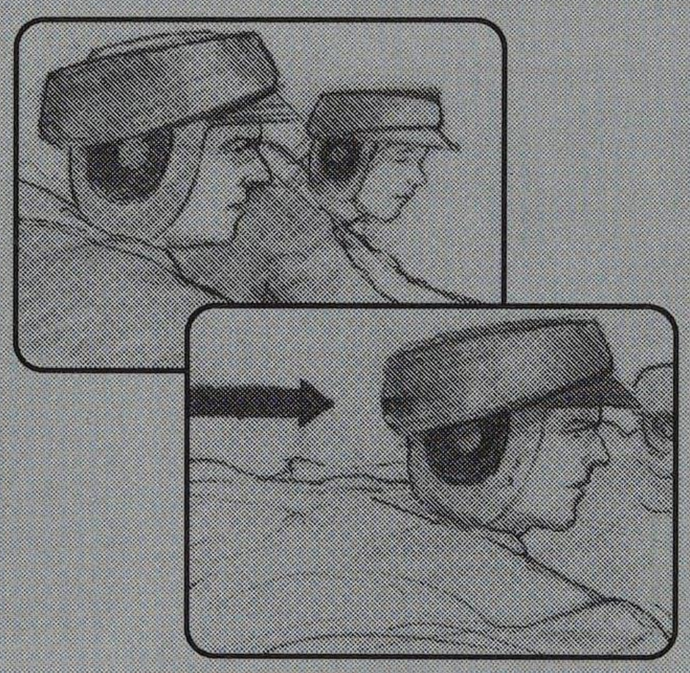
of the scene? And also, how did this shot start and how is it going to end? Because it's a movie, it's moving imagery, and you need to know those things.

"Secondly, there's also concepts of screen direction and camera progress that we have to obey. If action moves left to right, then everything needs to go left to right. If people are talking to each other left to right, you want to keep that relationship when you do the cut, and so on. I helped bring a more highly developed sense of that to the project. Working with Paul Topolos, who did the storyboards, I was able to find areas where they were just jumping the tracks when it came to the technical aspects of how to organize moving images."

For several months, Barwood joined heads with Topolos, a professional storyboard artist, to create a shooting script, something that Barwood could take into a video studio and use as the basis for a tight, economical video shoot of live actors. When the second set of storyboards were completed, they counted 165 sequences that needed to be shot.

FROM STORYBOARD TO GAME SCREEN

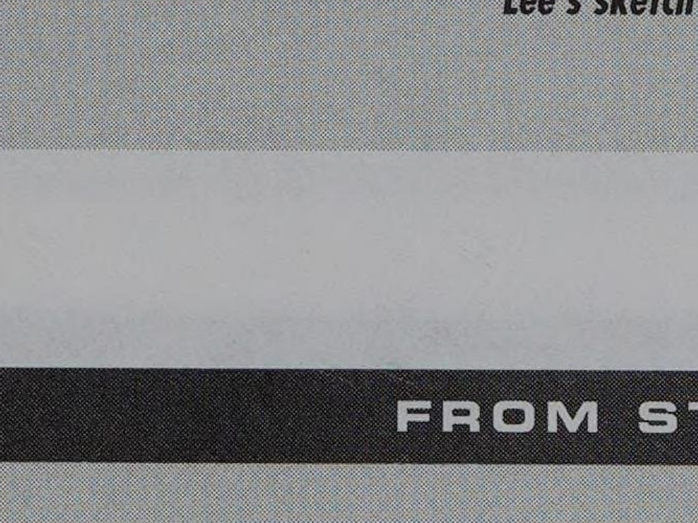
Lee's sketch



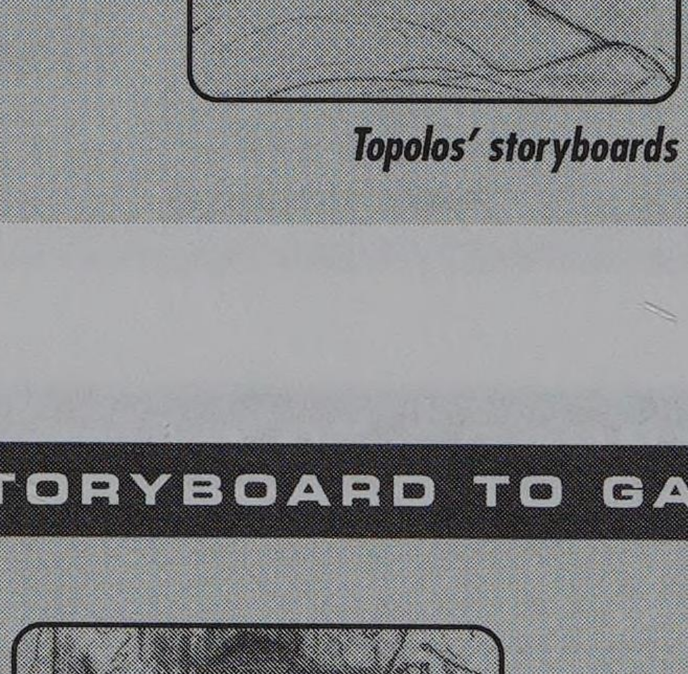
Topolos' storyboards

Game screen

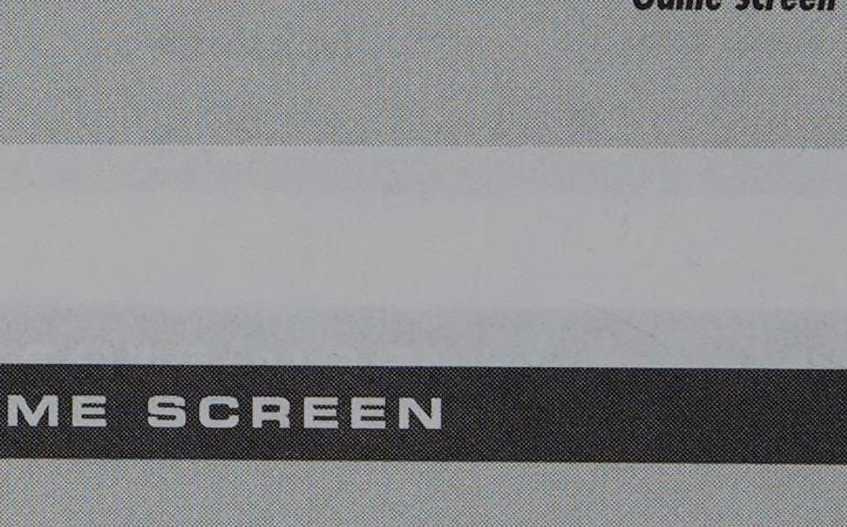
FROM STORYBOARD TO GAME SCREEN



Lee's sketch



Topolos' storyboards



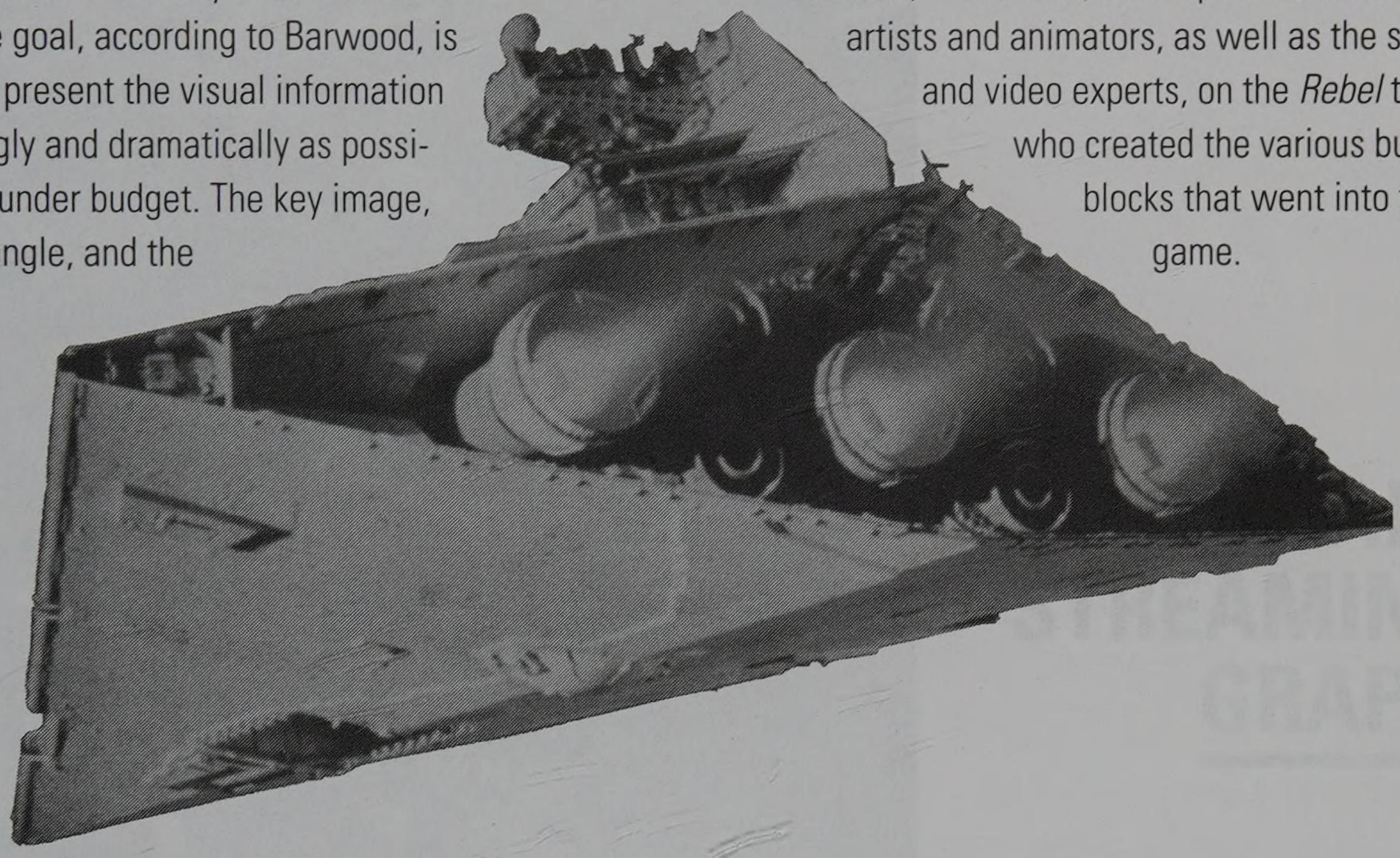
Game screen

"Most of the time, the original conceptions of the sequences were just wonderful and I just had to do revisions," Barwood said. "Very rarely did I invent anything. I just kind of cleaned up the stuff that the team was trying to do. I helped them to express what they wanted to do, to see their vision to the computer."

The following shooting script for Level 6 and the cut scene before Level 7 reveals, when compared with Lee's initial script, how much more specific visual information is needed to actually shoot video sequences. The goal, according to Barwood, is to be able to present the visual information as interestingly and dramatically as possible, yet stay under budget. The key image, the camera angle, and the duration of the shot is spelled out for each frame. Note also that each frames is composed of a different layering or mix of video footage, 3D backgrounds, and 3D animation.

The shooting script ends the pre-production stage of a game like *Rebel Assault II.* From here on out it's up to the artists and programmers to make the script a reality onscreen, much like carpenters and other contractors take an architect's blueprint and turn it into a building.

In Part II, Production, we'll speak to the 3-D artists and animators, as well as the sound and video experts, on the *Rebel* team who created the various building blocks that went into the game.



CHAPTER 6

THE ART OF STREAMING 3D GRAPHICS

The Art of Streaming 3D Graphics

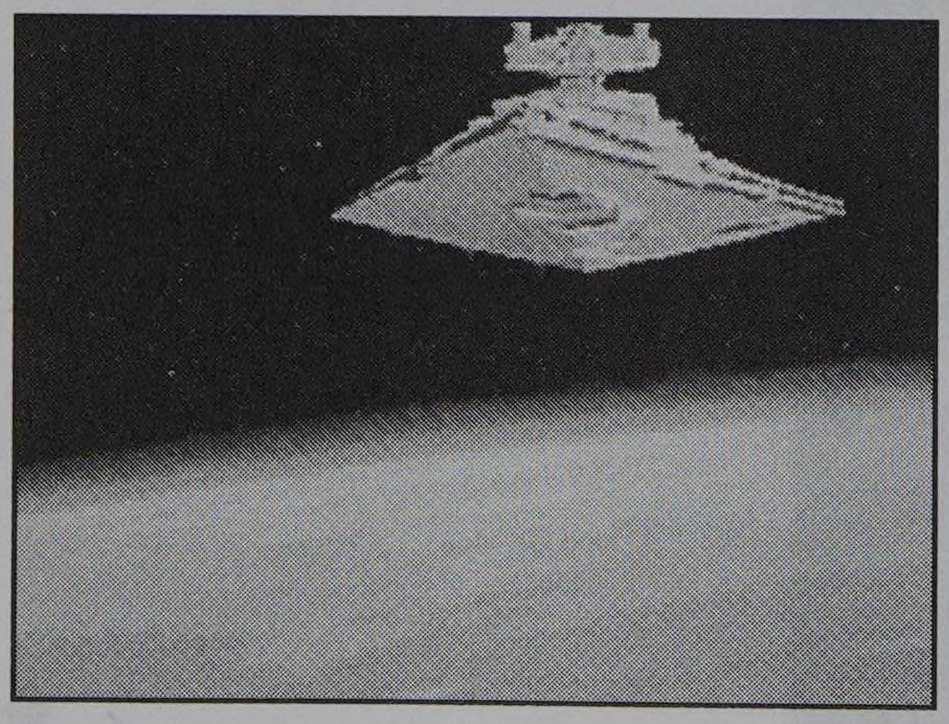
The question is simple: How do you get the look and feel of a Star Wars *movie on a computer-game budget? The answer is complex. In the original* Rebel Assault, *the art-production team dove into the brand-new technology of 3D animation. Vince Lee had this wicked notion of grabbing graphic information off of a CD-ROM so fast that it would look like "streaming video" onscreen and be free of the hitches, pauses, and gaps from which most CD games suffer. The result was spectacularly successful in* Rebel Assault, *both onscreen and at the cash register.*

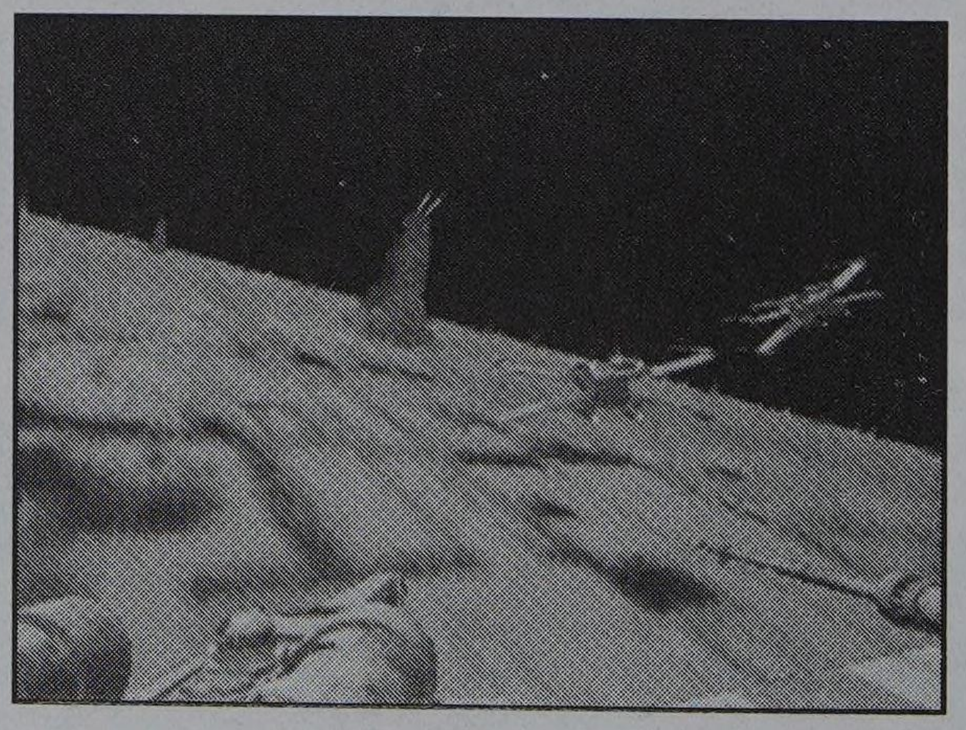
For Rebel Assault II, *the art squad wanted to punch through the technological edge once more. Top-notch 3D animation wasn't an old science by any means, but they*

wanted something new, something that would drastically heighten the realism of interstellar battle. Video became that new technology frontier. They would lace together, or composite, video footage of actors with computer-rendered 3D backgrounds and sets. And the goal was to do it so seamlessly that, perhaps for the first time, the game would truly look like a movie.

To pull it off, Vince Lee tapped Rich Green, one of the 3D artists on *Rebel Assault,* to be the lead artist for *Rebel Assault II.* (If you want to check out his early work, go back to *Rebel I* and replay the Star Destroyer level and the Death Star trench finale.) It was quite a fortuitous choice because Green had just finished some pioneering work on the LucasArts game *Full Throttle,* combining 3D animation and 2D illustrations for the first time with spectacular results.

I spoke with Green in a conference room at the LucasArts headquarters about a year after he had come aboard the *Rebel Assault II* project and just a month or two away from ship date. This is the traditional "crunch time" for a game, when long days get even longer, the pressure to finish grows intense, and it becomes increasingly difficult to keep your spirits high and your inspiration strong.





The* Rebel I *levels Green worked on when he first came to LucasArts.

REBEL ASSAULT II AND 3D ART

Backstory

What did you do after you finished *Rebel I* and before it became obvious *Rebel II* would be a go?

At the end of *Rebel I*, we had a kind of down period because we didn't really know if 3D was going to be big. There wasn't a project for us to move onto, but they wanted to keep us around until they saw how things went. There was a document floating around that I saw for a game that eventually became *Full Throttle*. I always wanted to do more mixing of 3D art with 2D art because I think the 2D artists we have are the best in the business. I really wanted to know if we could make 3D art look as good as the 2D art, but I wanted to take it down from what we were doing with *Rebel Assault* and make it a little more cartoonish, with a little more exaggeration, and see if that would work.

So right after *Rebel I*, we had this R&D period, and I did some tests. I put some 3D models on 2D backgrounds, trying to integrate them into the scene to see how they worked and to see how easy it would be to set it up — and the test came out pretty well. I think it had a lot to do with the decision to use a lot more 3D in *Full Throttle*. When the project got the green light, Tim Schafer, the project leader, decided to do a lot of the vehicles and things in 3D. So for the next seven months, I ended up building models for that game — bikes, cars, trucks — 14 vehicles in all were built.

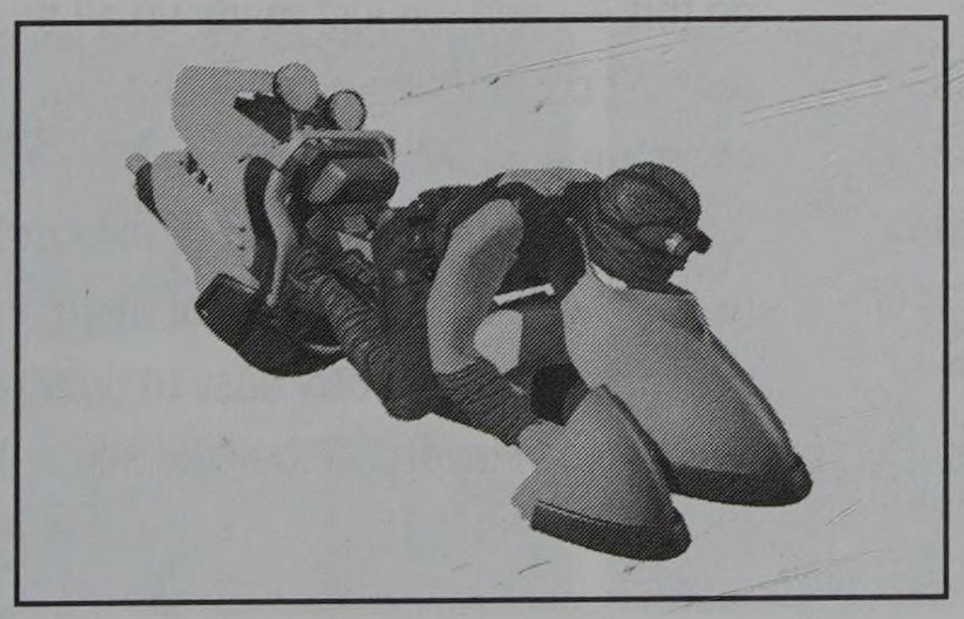
How did you make the transfer from 3D artist on *Full Throttle* to lead artist on *Rebel Assault II*?

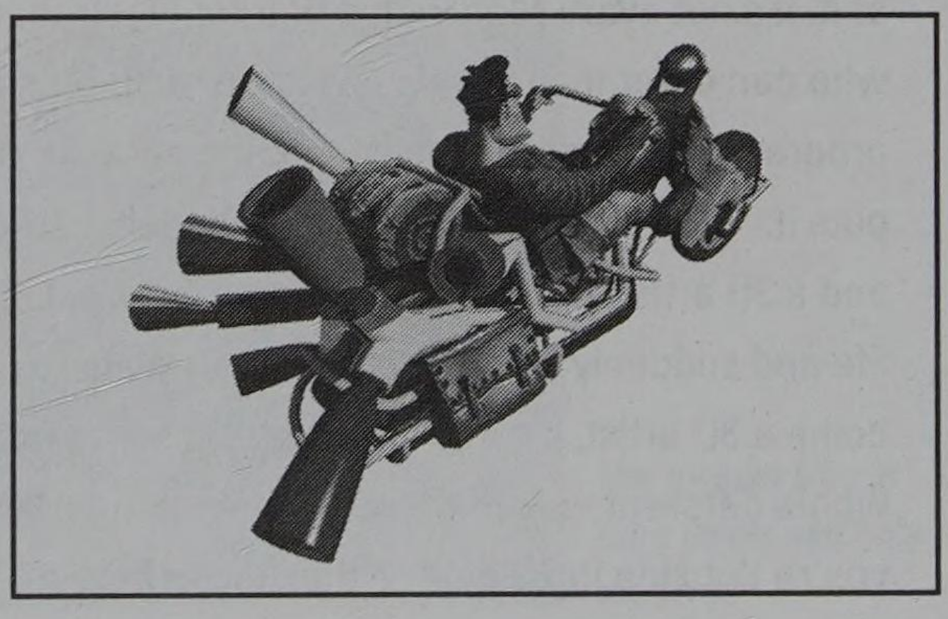
I guess in about July [1994], Vince came to me and asked if I was interested in being the lead artist on *Rebel II*. Of course I was right in the middle of *Full Throttle* and thinking, "What do I do now? I want to do it, but I don't want to bail out on this other project." Luckily, we had a couple of very talented 3D animators, Dan Colon and David Vallone, and at that time, the model building for the game was finished and all that was left was animation — and they were able to come on and take over. The idea was that I would help get them into the project, get myself out of it, and let them take over at the end. So I started working on the art lists for *Rebel II* at the same time. For a while, I was working on both projects and putting in some pretty hectic and long days.

Early Stages

How did you put together the art list for *Rebel II*?

Vince had a script and we knew pretty much where the levels would take place. You go to this planet or to this base, and I basically had to go in and break all that down into shots. Like for this line here, we'll show a close-up of this pilot saying this. And for this line here,





***Two of Rich's favorite vehicles from* Full Throttle**

REBEL PROFILE

RICH GREEN
Lead Artist

Rich Green

So you want to be a cyber-edged, plugged-in, streaming 3D artist. What do you do? Where do you go? One thing you don't do, according to Rich Green, lead artist on *Rebel Assault II,* is run out and buy the software.

"The bane of our industry is people who decide that they are going to be a 3D artist now, and they get a computer and a 3D program and call themselves an artist. Some people will have a natural affinity for it and some people will never get it," said Green, who was a key 3D artist on *Rebel Assault* and *Full Throttle* before he was asked by project leader Vince Lee to lead the art team for the *Rebel* sequel.

When you talk to Green, it's clear that 3D animation is worlds apart from drawing board and pencil, and it takes a special skill, or sensibility, to be good at it. It's not every Moe with a flair for illustration who can enter the virtual universe of a 3D animation program and emerge with something cool. As Green puts it: "There's a big difference between a 2D artist and a 3D artist. If you're trained as a 2D artist all your life and suddenly you're a 3D artist, or want to become a 3D artist, it's a whole different set of rules, a whole different way of thinking about things. When you're thinking in 2D, you're thinking of how to best

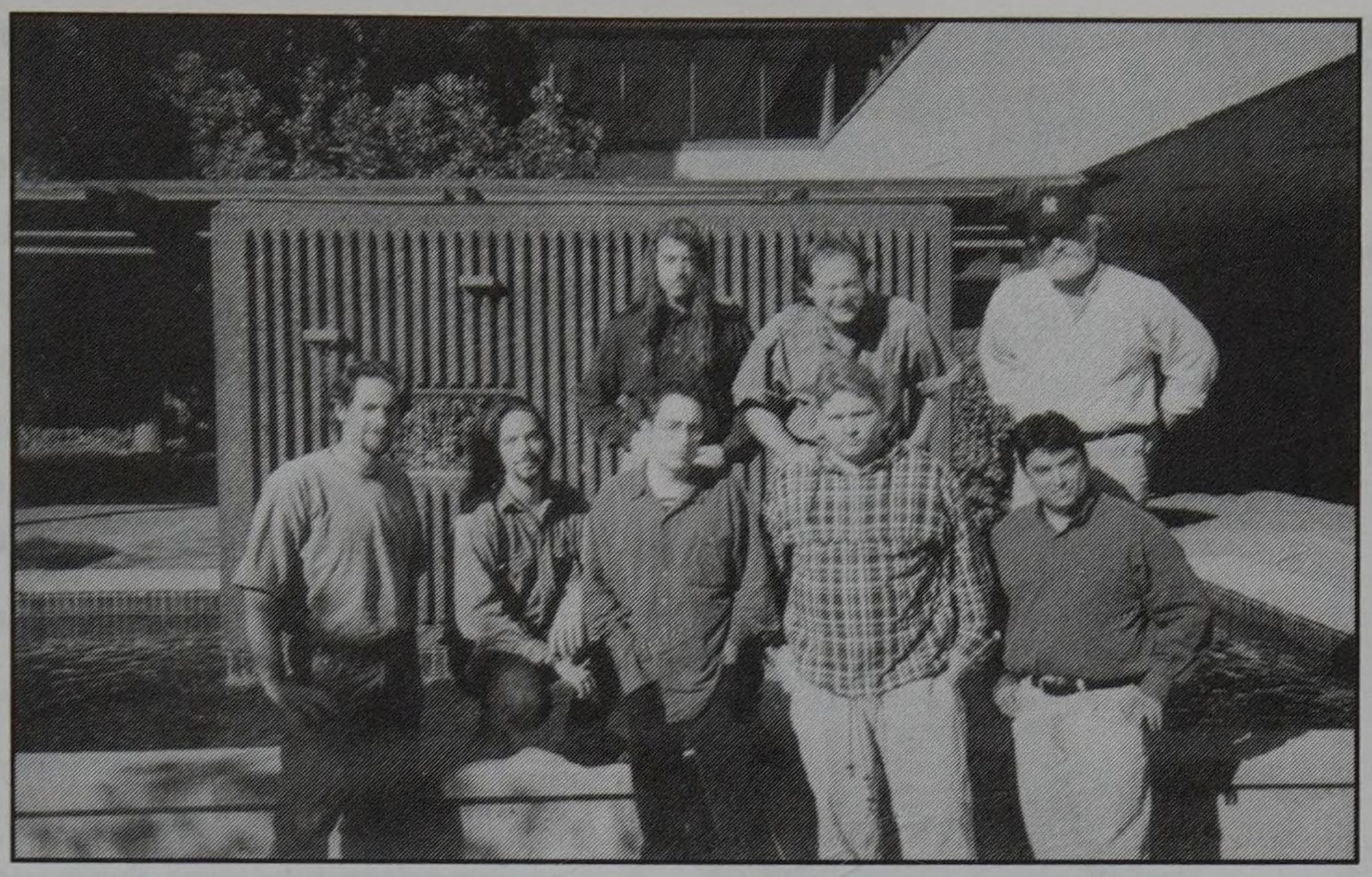
we'll cut to this. It's very similar to movie making. Once you have a script, you have to start breaking it down and figuring out what shots you're going to do in order to show these things. I'd do the preliminary art list and we'd go in and do lots of editing and changing and adjusting. That actually takes quite a while. That took us a couple of months to do that, so we really hadn't started on any art work at all yet— and this was getting into September [about a year from ship]. It was getting pretty late.

With that tight of a schedule, did you have to have more artists working on *Rebel II* than *Rebel I*?

It wasn't just the schedule. It was a lot more art. At any given time, I think there was a maximum of about four artists who worked on the first game. For the new game, we had an outside contractor as well as our in-house artists working on the project. At the peak, there were about 12 artists full time. There were so many that I sometimes felt it was all I could do just to set the wheels in motion on a shot or a sequence and then just stand back and let it happen. So much of what's great about this game came from the artists. They were able to add so much more to it than I was even capable of thinking of.

Is the art in *Rebel II* that much more complex?

Oh, yeah. [Laughs with disbelief.] I don't know what I was thinking at the time. We just got excited. Oh, yeah, and then we'll fly to this base and then we'll have you do this — and we just made up all this stuff, and we weren't considering how much time it was going to take to create it all. Maybe we weren't being as realistic as we should of been in terms of the complexity of it all. I mean, the first game had a lot of TIE fighter levels in space, which are pretty easy to do artwise, and then some trench levels. In the next script, Vince structured it



The 3D artists outside the new LucasArts headquarters: (L to R) Jon Knoles, Eric Ingerson, Clint Young, Dan Colon. (On ledge, L to R) Ron Lussier, Craig Rundels, Garry Gaber, Bill Stoneham. Not pictured: Richard Green, Seth Piezas.

so that we had a lot more places to go and different ships you could fly. It was good in that respect because we tried to break up the levels. The hard levels are later on in the game, the easier levels are earlier on, and the TIE fighter levels are spaced out well. Unfortunately, with so much to do, we had almost no preproduction time, which was a disappointment.

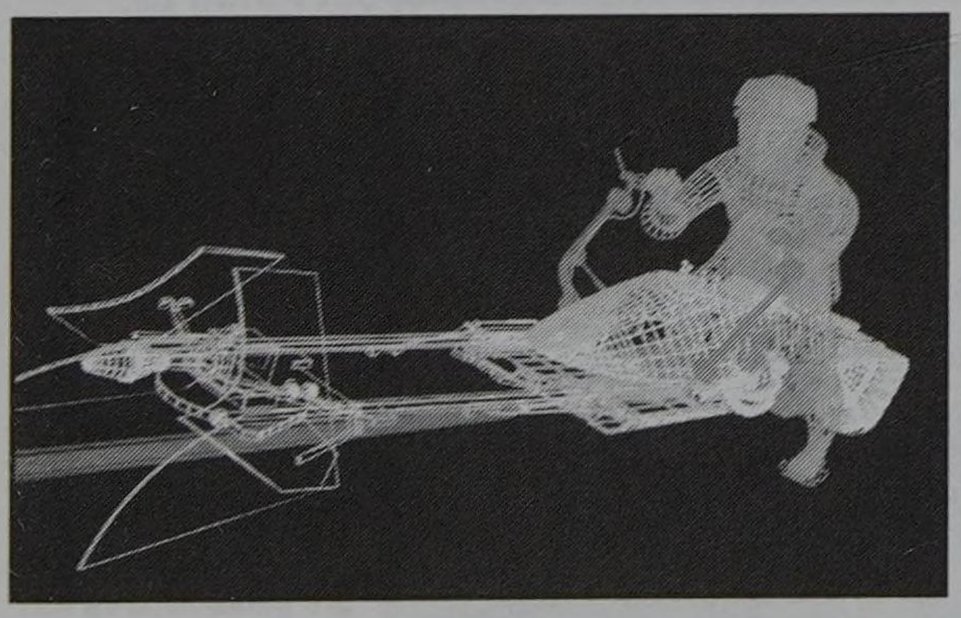
What would you normally do in preproduction?

For all these bases and planets and ships, we would sit down and draw it all out. I did do a few drawings here and there of a base, a mine, a satellite, some little thing here and there. But there just wasn't that period when you would really like to sit down and go through the script and just start designing everything, which makes it so much easier to communicate the ideas to the other artists. You can just hand them off drawings and say, "Here's what it looks like" or "Here's this scene" or "Here's this interior." But a lot of this had to be done on the fly. I'd come up with a real quick sketch and say, "Kind of make it like this." The artists had a lot of leeway to add in their own details and come up with their own stuff.

The Real Work

You said there was a lot more art in the new game.

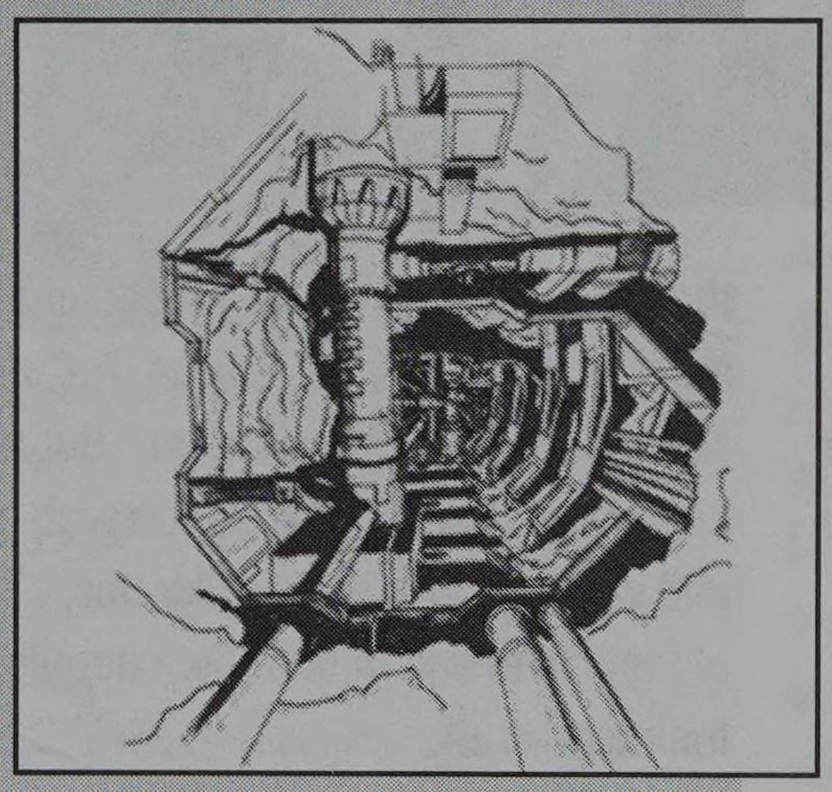
When you look at the amount of stuff that we've done in 10 months, it's pretty amazing. In just model building alone, it's probably 10 or 12 times as much as the first game because of all the extensive interior scenes and



The speeder bike in wire frame and fully rendered

REBEL PROFILE — RICH GREEN
Lead Artist (continued)

represent real-world objects, or three-dimensional-type objects, but in 2D. Now you must start thinking about how to do 3D objects in 3D, and all those sides and details that you can't see in a painting or a drawing are suddenly there and visible. And so you really have to consider the whole thing. And *then* you have to set the image into motion."



One of Green's tunnel sketches

It helps if you can put on your movie director's thinking cap. "First and foremost," Green said, "you need to think really cinematically. And that's one of the hardest things to teach people. If people are interested in film or animation and really look at shots, how things break down, how action is set up, screen direction — all the little things that are involved in film making, because that's basically what you're doing, you're a director, you're composing a scene — that's just an amazingly valuable skill."

It's a skill the 31-year-old Los Angeles native started to hone in high school by shooting super-8 and 16mm home movies. His subject? *Star Wars,* of course. "I was really into space," Green said. "When *Star Wars* came out, I was 14, and that was sort of a turning point. When I saw it, I freaked out and went home and started building stuff with all these costumes and props. I spent my high school years being a major *Star Wars* geek, making movies."

things that you fly through. And in animation, we have some much longer levels. We're going onto two disks for this game, so it's obviously a lot more than the first game. It was a huge undertaking. And it was all new to me. I was not a lead before, and I had to try to organize it all and hand it off to people and get people interested and make sure they were sticking to the plan.

Did all this organizing keep you from creating any levels yourself?

[Laughs.] I'm still working on my one level on this game. It's Level 10, the speeder bike level. I wanted to save one cool, new, fun thing for myself. I think it's looking good. Early on it was hard to work because there was so much paperwork and so much tracking of shots and so much organizing and we didn't really have a production coordinator on the project yet. Other projects had gone the same route, and as they started to get more complicated, the leads and the project leaders got bogged down with paperwork. So they decided we needed somebody to come and take this on. That's when Llesll [Aclaro] came on. Without her, none of this would have gone as smoothly as it did. She's been really great.

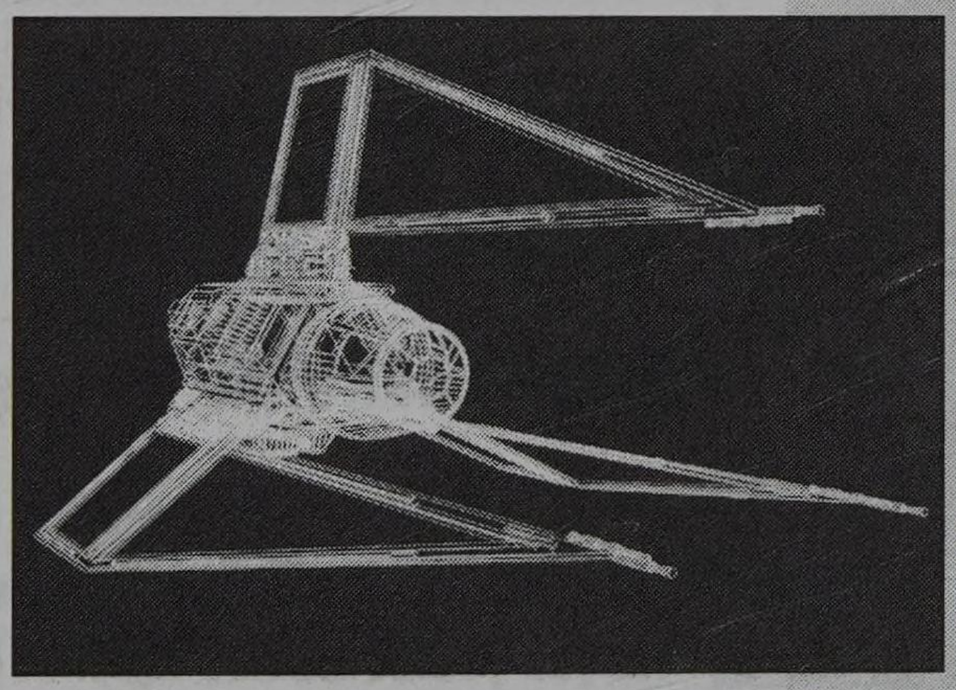
With so many artists working on the project, and without a sustained preproduction period where you nailed down a look for the game, does the game actually have a single, unified look and feel?

I think it has a unified look as a whole, but I tried to make sure that each location had a distinct look and feel while still having that *Star Wars* look to everything. That's the hardest thing, to try to maintain that *Star Wars* look. The Imperial bases and locations and objects have to look a certain way, and the Rebel things look their own way. For example, the Level 6 base. We knew that it was in this asteroid field, and we knew that it was

a base that was mining asteroids. That was the only criteria. I ran it by one of our artists, Jon Knoles, who is a major *Star Wars* fanatic and has worked on a lot of *Star Wars* games that we've done in the past. And he's a good designer, too. We just bounced ideas off each other and started drawing things and getting excited and saying, "We could do this, we could do that." In the space of a couple of hours, we came up with this Saturn-style design with a big asteroid in the middle and a big disk around the outside. He did a quick sketch of what it would look like and I built the model. It came very fast. He showed the sketch to Vince, and Vince loved it, and we just came back and did it. It had to be very quick, very seat of the pants.

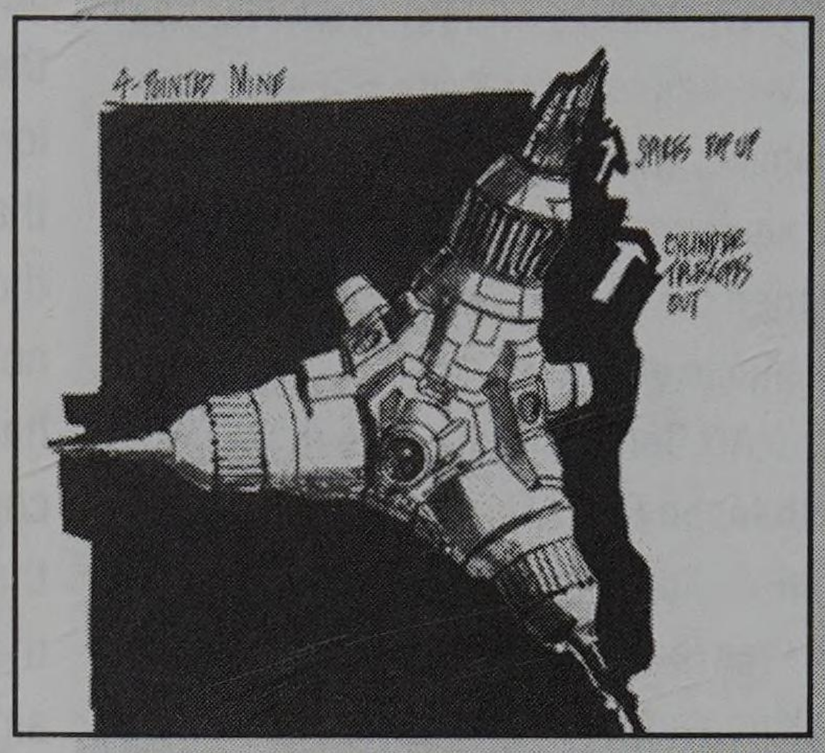
What game feature was the hardest to design?

The new, secret-weapon TIE fighter. TIE fighters had been done for other games, like the game *TIE Fighter,* but they really didn't fit because this was a new weapon, so we needed something totally new. We went around a little bit on this one. I would come up with



The new cloaking TIE fighter in wireframe and fully rendered

REBEL PROFILE
RICH GREEN
Lead Artist (continued)



A sketch of those pesky mines.

What separated Green from other teenage home-movie directors was an obsession with something you'd have to call *3D-ness.* "I built models. I had been building models since I was 5 I was really into it. I had a nice little workshop area in my garage and I would just start 'kit bashing' models and building my own stuff. I was especially interested in the special effects of *Star Wars,* and I read all the stuff I could on special effects and how they built the models and used parts from different models."

He also read that many of the people involved in the making of *Star Wars* were something called industrial designers. After high school, Green enrolled at the Art Center College of Design in Pasadena, California, to pursue his dream of film making. When his instructors saw the drawings, sets, and miniatures he was creating for his special effects, they asked him if he had ever thought of industrial design. "And I said, 'Well, I don't even know what it is.' When they told me, I thought it sounded pretty interesting. It was sort of an art-based business. You get to draw things, design things, then build them — computer equipment, appliances, anything mechanical that

REBEL PROFILE — RICH GREEN
Lead Artist (continued)

is manufactured." Now Green understood why industrial designers worked on *Star Wars.* "The skills needed are very similar," he said. "For movies, you have to be able to sit down and design something from scratch and then build it. And that's pretty much what industrial design is all about."

After leaving the Art Center in 1988, Green followed friends north to the Bay Area, an apparent hotbed of industrial-design magic. He didn't know it at the time, but he was forging a new career in 3D-ness: part film-making, part real-world industrial design, part computer graphics and presentation. He see-sawed from freelance job to freelance job, trading security for a wide swath of experience. For a while he worked 2D with his Macintosh as a desktop publisher. "It was OK. It gave me a lot of computer time." Then he fell into a 3D job at the California Academy of Science in Golden Gate Park, building museum exhibits. "They had a big dinosaur exhibit they were installing in the museum, and I worked on that," he said. "That was a really fun job, riding your bike into work. Working in the park was not a difficult thing to do."

Green getting his hands dirty on the dinosaur exhibit.

Next up, more 3D, but this time in a real film, *Robocop II,* with one of Hollywood's top film animators. "I worked for a short time at Phil Tippett's studio. Phil is a stop-motion animator who worked on something and show it to Vince and he would make suggestions about it and change things. There was one sketch in one of the *Star Wars* art books that I used as sort of a basis for it. It was actually an early design for the Imperial shuttle. It had this ball front end with this long body, almost like a dragonfly, and then these wings that came up and hung way out over the front. And I thought it worked for this. I could do this TIE fighter nose part that's sort of reminiscent of a TIE fighter; it has the same window pattern and things like that. I could take the wings and put the panels in and make them look like TIE fighter wings. And one of the things that Vince wanted on it were big scoops that looked like air vents or air scoops. It was a challenge to come up with something that looked slick and kind of scary. But I'm happy with the way it turned out.

Are there any restraints put upon you from the *Star Wars* movies about what you can and cannot do?

There are common looks to things. Take the Level 6 base again. As soon as we came up with the asteroid and the disk around it, it was really natural. If there was a disk around this, it would look like this, with these types of details. It was easy to look at the movie books to see the patterns and textures on the surfaces that would let things appear different but similar.

3D Animation in a Nutshell

What is the actual process of doing a level in 3D animation? Because it was so new then, maybe you could use the first game for an example.

At that time, CD-ROMs weren't big. They were almost unknown. Nobody expected *Rebel Assault* to be a big game at all. When we came in, we had no idea that this was some great project that was going to be huge in the future. It was more of an experiment. That's the feeling I got. I came in and it was very loose. There was no art

direction per se, what to do. It was all pretty open-ended. "OK, in this level, you fly around a Star Destroyer." And I said, "Well, what, how?" I didn't know anything about it. And they said, "You know, you just fly around it and you shoot out targets and make it interesting." It was a very spontaneous way to work. And I just sat down at my computer and started doing it. It was a lot of fun and I loved it.

The first thing that I did was use an existing Star Destroyer model that someone else had built. So I looked at the model and saw that it needed work. I went in and built a bunch of detail to make it more interesting because you're going to be flying really close to the section. I took some liberties and created these gun turrets that may or may not be there in the movie, but you can't see them because the scale of the movie ships is so large. You need to make targets for a game, however, so you might have to make compromises between the game and the movie. You have to make it look interesting *and* give yourself something to do while you're flying around shooting things. So I put the gun targets in there. Then I would set up an animation. In this instance you're basically making a big loop around the Star Destroyer and shooting out guns along the side. I'd do a preview of it, Ron Lussier would look at it, and we'd go, "Oh, yeah, that's good, that works," and I just went ahead and did it.

How long does it take to complete a level?

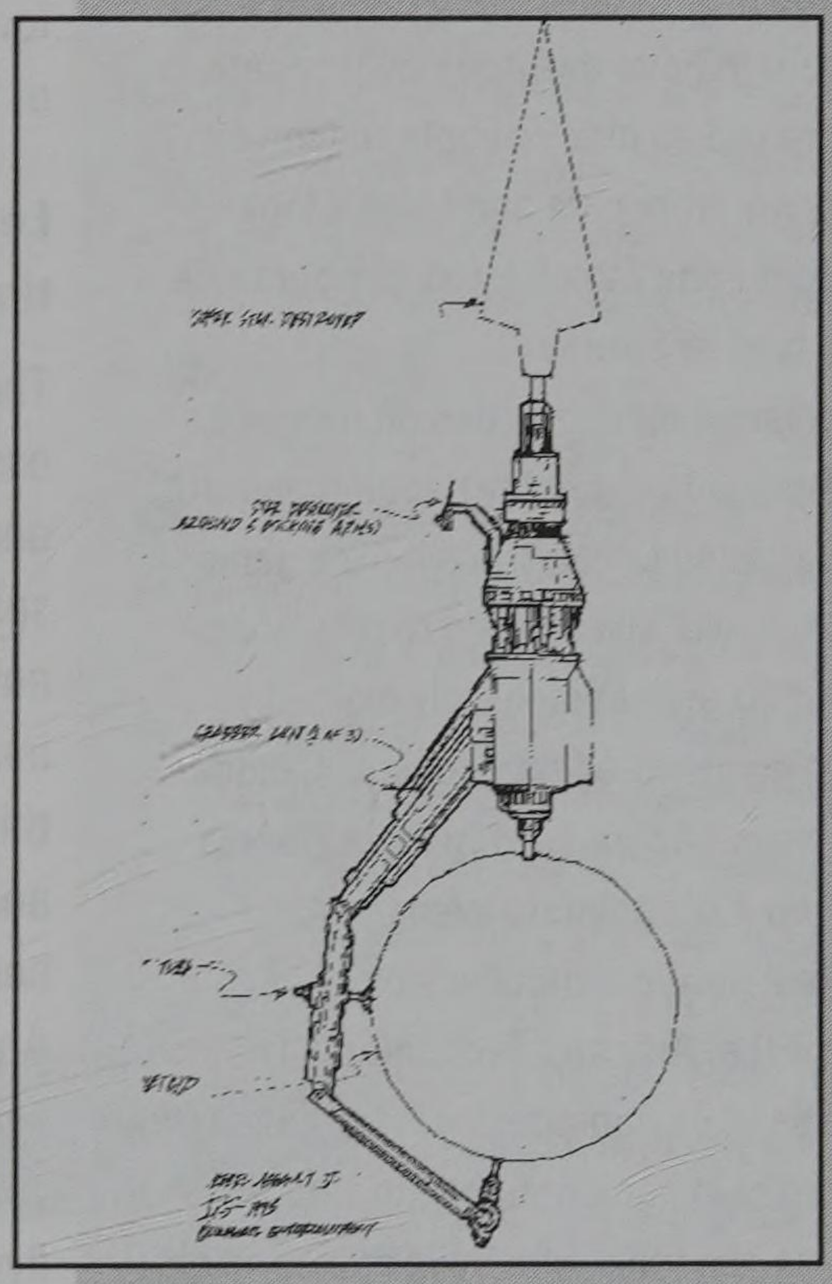
I came in May 1992, and we finished up the art in October. I did two levels, and I guess it took about two or two-and-a-half months per level, maybe three months. Some of the levels in this game took longer that that because the modeling was much more involved than in the first game.

REBEL PROFILE

RICH GREEN
Lead Artist (continued)

the early *Star Wars* movies and did some other movies like *Dragonslayer.* He's probably the best at it in the world. So that was sort of a dream job."

Stop-motion animation is a movie making technique that uses miniature sets and miniature models to create reality when reality won't work or is too expensive. You shoot the models in close-up one frame at a time, move them a bit, and shoot them again. "Sort of *King Kong* style," Green said." "In the movie, they had the evil robot who battles the Robocop character. It was supposed to be the next level of robot police; a big, crazy robot that was using the brain of this insane guy. So we built a lot of miniature sets that they had battles on."



This sketch of the Level 15 base looks like something from Green's industrial design days.

His favorite set he built was of a huge basement of a high-rise building that was filled with boilers and pipes. Robocop and his nemesis crash through the

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RICH GREEN
Lead Artist (continued)

roof of the building and then tear up the underground place as they battle. "They had a giant, full-size prop of the evil robot, from the torso up, and then they would do close-ups of it doing its mechanical things and close-ups of Robocop being grabbed by it or pinned to the ground by it. But everything else is a miniature."

Green loved the work, but he also discovered that his quest for 3D-ness would probably not follow the Hollywood path to fulfillment. Something about film making wasn't right. "It was a very, very stressful job," he remembered. "Film production is very different than game production. The deadlines are absolute. You've got to have this done by this date or else because there are so many people relying on what you do. I felt my work was good and it looks good on the film, but I don't think I was cut out to be a film-production type of person."

So back to freelance industrial design he went. He was unknowingly but inexorably heading toward a parallel universe called LucasArts where a game called *Rebel Assault* was just starting to take shape and the concept of 3D animation barely existed. Green was designing video-editing consoles, digital-video storage units, headphones, and laboratory instrumentation when a schoolmate from the Art Center called from a now-defunct division of Lucasfilm named Rebel Arts and Technology. They were in the process of designing a location-based entertainment system in conjunction with Hughes Simulation Systems, the folks who build military flight simulators. Lucasfilm was doing the whiz-bang surface design and Hughes was to do the innards.

"For about 12 weeks — an incredibly short period of time — we built this huge prototype," Green said, laughing. "We didn't really have a name for it. We just called it 'the pod.' This big, giant structure that sat two people inside of it. You actually walked

Did you use 3D modeling in the cut scenes between levels?

All the scenes that are not "playable" are considered "cut scenes" and these usually included animated 3D models. The first shot I did after arriving at LucasArts was the cut scene of three X-wings leaving the damaged Star Destroyer at the end of Level 4 [of *Rebel I*]. After the model details were added to the Star Destroyer, I created the planet in the shot and set up the animation of the three ships heading to the planet.

What do you mean by setting up animations?

It's like choreographing action on the computer, where you want things to be. I'll put the ship down here and then place the camera and animate the camera to follow the ships around and record the action There's a lot of freedom to do whatever we want to do.

Let's be even more specific. What is 3D animation? How would you define it?

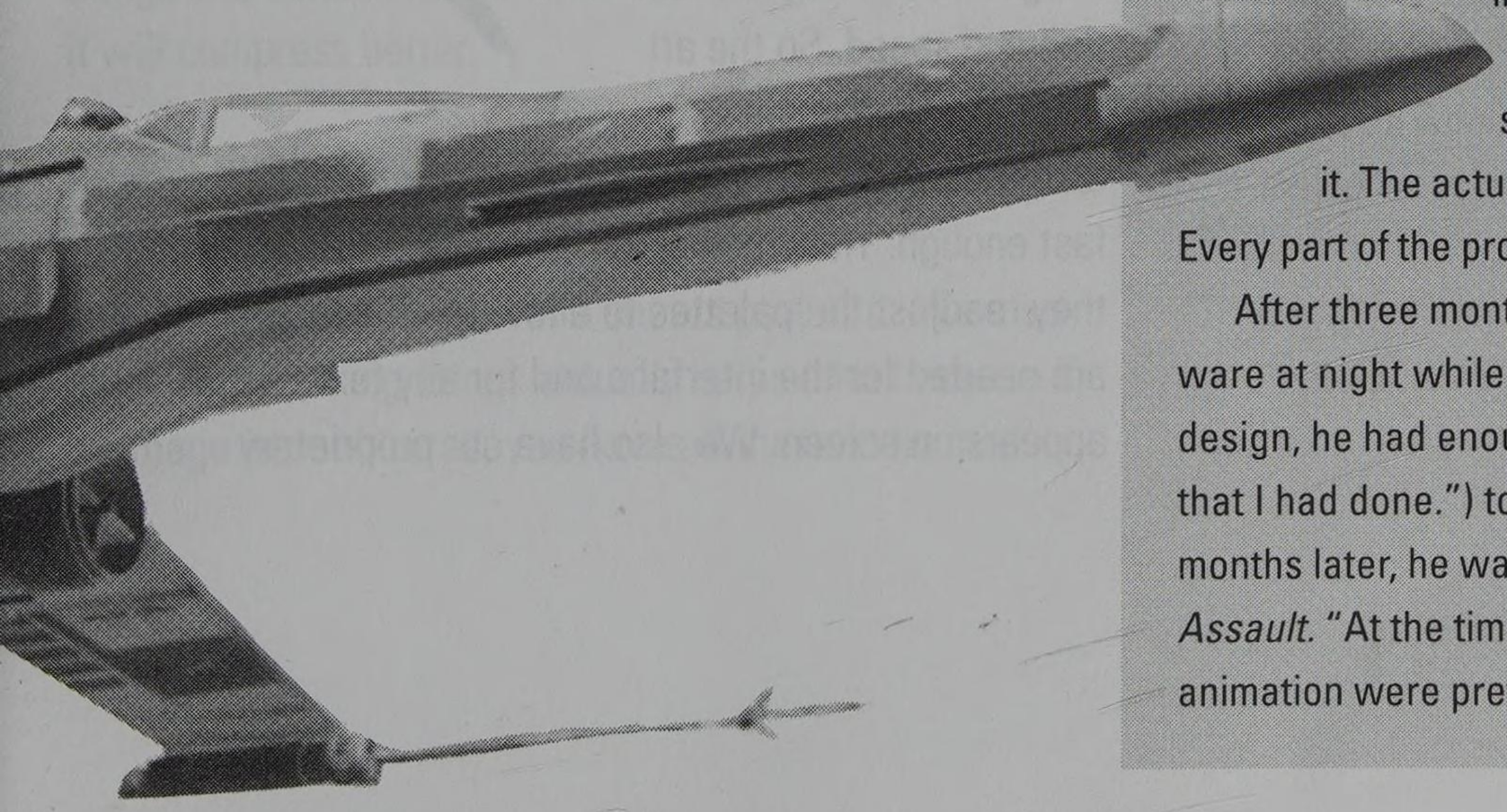
The closest metaphor is movie making. You have in essence a stage in the computer that is this workspace, and the 3D models sort of sit in this space. You can place things anywhere you want. Just imagine that you have this infinite space, or box, and you can put a model of ship here and a model of a planet here. And then, just like a movie camera, you point the software camera right at your subject. If your ships are flying up and to the planet, you just follow them up. Unlike movies, you're not recording in

finished images. You're working in wire-frame models because the computer can't render out the finished image fast enough — at least not yet. So you work in wire frame and set up the animation in these paths where the ships are going to fly along, how the camera is going to turn. You set up your lights to illuminate everything. And when you're all done, you can do a quick preview of it to see where things go and how the speed of it looks. Then you actually render out the scene which can take, depending upon the compléxity of the scene, anywhere from two to 50 minutes per frame.

Explain rendering.

The wire-frame models are all in place, but in order to make them look realistic, you have to create texture maps that are applied to the surfaces of the models. Then the computer has to call up those texture maps and the instructions for where to put those maps, and then it has to calculate how the light hits it and where the shadows are cast. It takes a lot of computing time.

With the first game I was using a 486, 66MHz computer. A machine like that would be impossibly slow now. We have some frames in the new game that take up to 45 minutes to render. And long animations can turn into a week of render time. Most of us now have Pentium 90s with 96 megs of RAM, and all of us have two machines so that we can be creating on one and rendering on another.



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RICH GREEN
Lead Artist (continued)

through doors to get into it. It was really an amazing structure when it was all done. I don't know how practical it was from a cost standpoint. It was all steel frame with huge fiberglass parts. If you had to build a bunch of these and install them somewhere, it would probably be pretty expensive."

A few months after they finished the pod, the Lucas division shut down, Hughes took over the project ("As far as I know, they're still developing it," said Green), and Green was back to unofficial 3D, freelance job training. But not forever. The skills he had been honing from pillar to post were about to find a suitable home. He interviewed with LucasArts, but they had no 3D division at the time and no apparent need for one. Then, in 1992, the momentum of his eclectic 3D experience finally collided with the brand-spanking-new graphic requirements of CD-ROM technology.

"I heard that they were working on a 3D project called *Rebel Assault*," Green said. "They told me what platform they were working on and what software they were using and it sounded interesting enough that I went out and bought a PC, a 486/66, and 3D Studio. It was really a natural thing for me. I just loved building stuff and creating stuff in 3D and doing animations. Everything I had done up to that point felt like it came together really well in doing 3D work. It was designing stuff on your own, then animating it. The actual building of the models I loved. Every part of the process I really liked."

After three months of teaching himself the software at night while working full days in industrial design, he had enough footage ("Some little scenes that I had done.") to send off to LucasArts. Several months later, he was hired to do 3D art for *Rebel Assault*. "At the time, the people who were doing 3D animation were pretty few and far between," Green

RICH GREEN
Lead Artist (continued)

said. "Even today it's really hard to find qualified people who are good artists and good technical people. I feel that LucasArts took a chance on me, not really knowing what they were going to get."

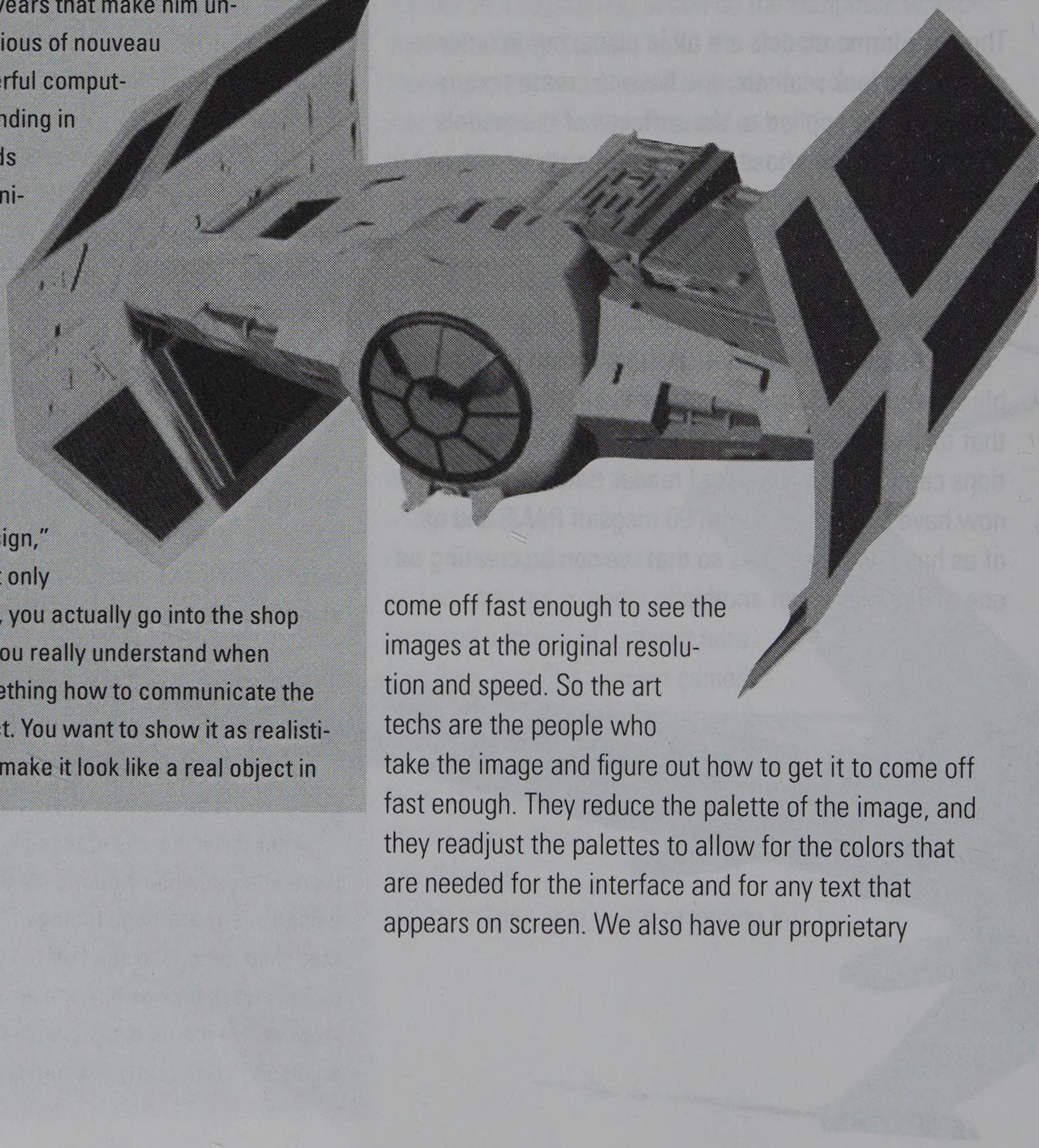
LucasArts didn't have to worry. For 15 years — ever since he had thrilled to *Star Wars* for the first time — Green had been unwittingly but very definitely soaking up experiences and training for an occupation that hadn't even been invented. And it's those 15 ad hoc years that make him understandably suspicious of nouveau 3D artists with powerful computers but no true grounding in 3D-ness. He demands depth in his fellow animators, and that's why he encourages would-be game animators to pursue training in film making or industrial design or (like him) both.

"In industrial design," Green said, "you not only sketch your designs, you actually go into the shop and build them. So you really understand when you're drawing something how to communicate the 3D-ness of the object. You want to show it as realistically as possible, to make it look like a real object in

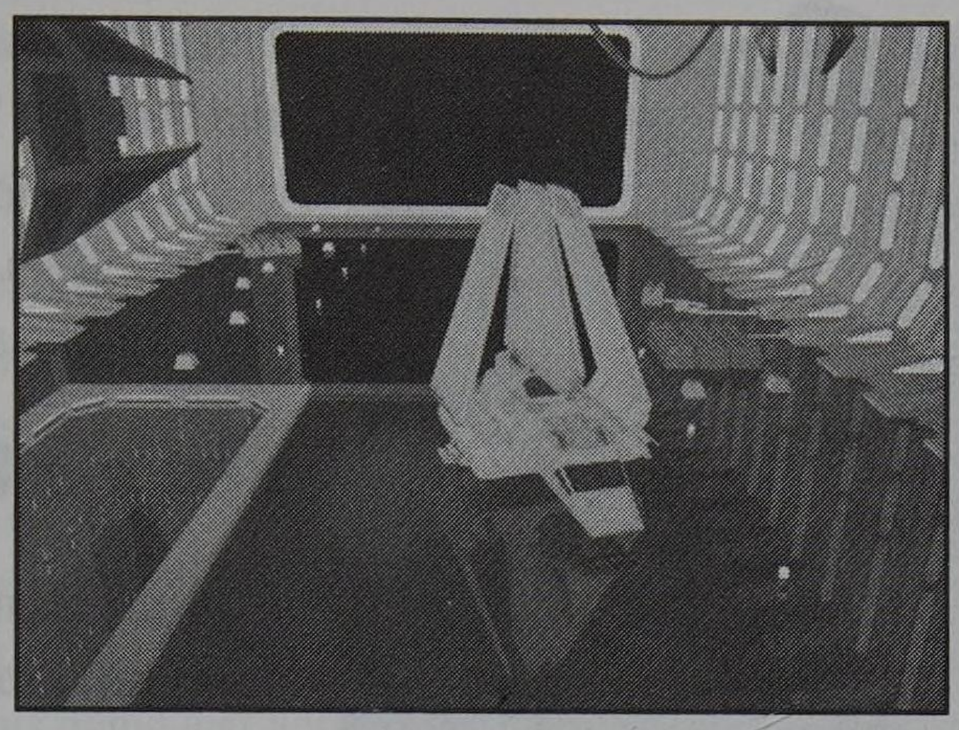
Art Teching

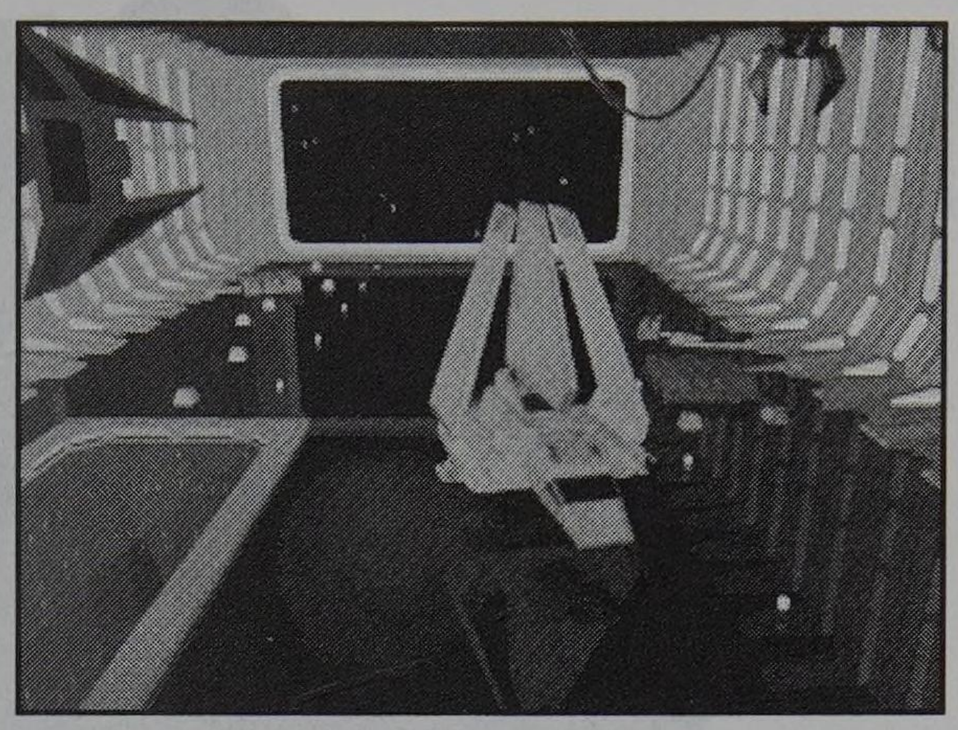
What's the next step after you've completed animating a scene?

There's actually a big step in the process that, unfortunately, doesn't get a lot of press. The finished animation goes to a visual effects technician. Because of the limitations of CD-ROM and people's hardware, you can't run animations the way that you can just play them back on my computer. I can render out an animation and then I can view it in an animation program. But you can't put that on a CD-ROM and have the information



come off fast enough to see the images at the original resolution and speed. So the art techs are the people who take the image and figure out how to get it to come off fast enough. They reduce the palette of the image, and they readjust the palettes to allow for the colors that are needed for the interface and for any text that appears on screen. We also have our proprietary





An original rendered shot compared to the compressed version that appears in the game

compression programs — we call it SMUSH because it smushes things down — that Vince wrote, and the techs run the image through that so that it actually compresses the image down. Every frame has to be below a certain frame size or it won't work.

Is the original image aesthetically altered after the visual effects technicians "SMUSH" it?

It depends on the shot. Some shots will look more compressed than others depending on the amount of movement in the shot. The compression is generally based on "differencing" a frame from the previous frame, so scenes that have less quick movement in them look less compressed because the information in the previous frame is similar to the current frame. Shots that have large areas of black, like ships in space, compress very well. Many of those shots look as if they have no compression at all. Sometimes we're able to take these things into consideration when we're creating a shot so it will compress better.

So you think about all that when you're creating the original images?

Yes. The amount of color in a shot is part of it. We also found that blurring things actually helps a lot because if an image is not blurred, you have all these individual

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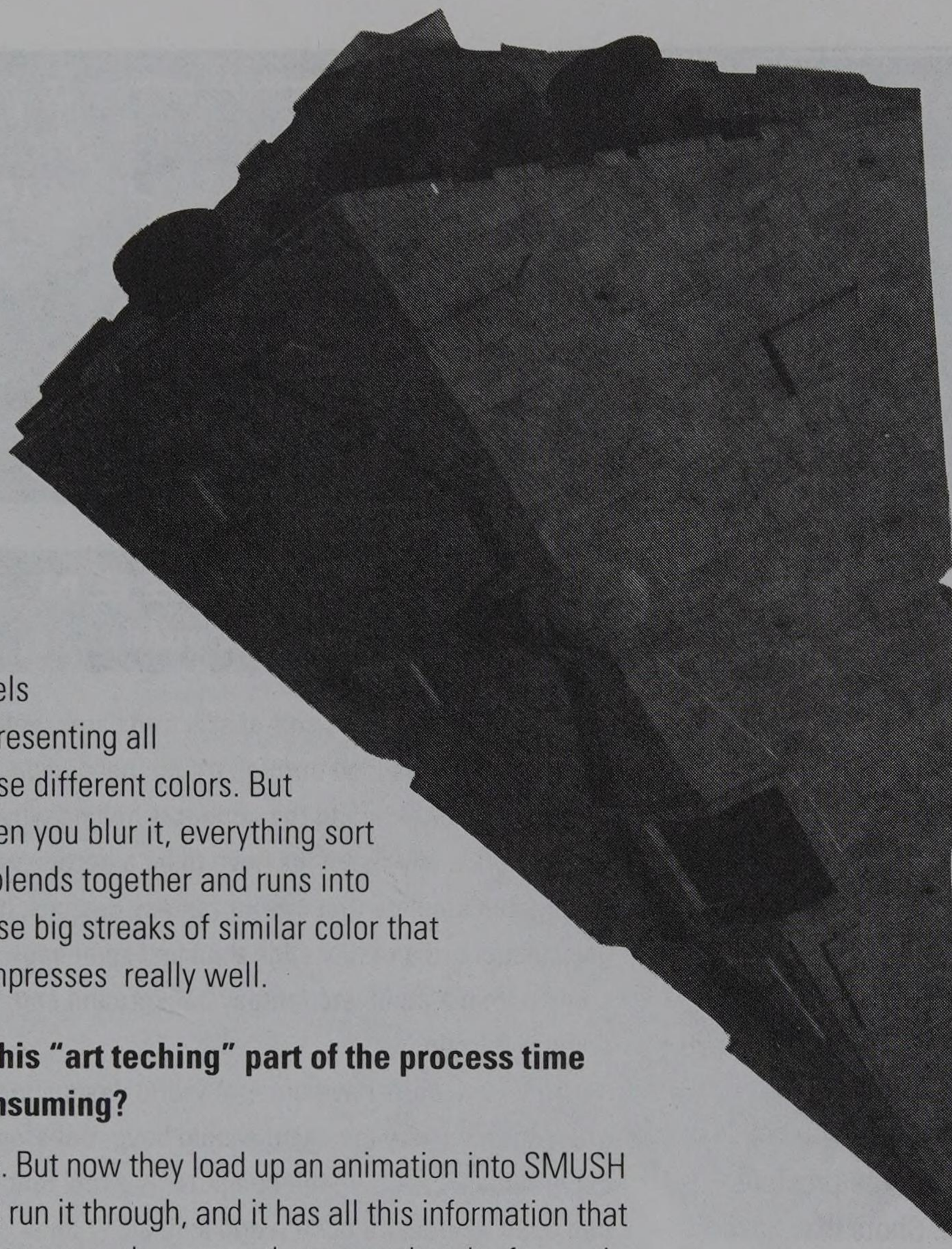
RICH GREEN
Lead Artist (continued)

the real world. And that sort of skill translates well to the computer. If you go through traditional design training, you understand the concepts behind why things work and why things have to be a certain way. So you can emulate that in your fantasy designs. It gives it more of a reality edge than just somebody coming from a complete fantasy background and doing illustrations."

And if you don't have the real-world design background, at the very least you should have real-world experience. For Green, the computer is a tool that can open worlds, it's not a world in itself. "I think you're much better off as an artist if you're looking at, and getting influences from, other things than what you do," he said." If you read nothing but computer and game magazines, you're not going to learn anything. You'll know what's out there and you'll know what other people are doing, but it's not going to tell you anything about the world. I think artists need real-world inspiration."



pixels representing all these different colors. But when you blur it, everything sort of blends together and runs into these big streaks of similar color that compresses really well.

Is this "art teching" part of the process time consuming?

It is. But now they load up an animation into SMUSH and run it through, and it has all this information that prints out on the screen that says what the frame size is, and they can adjust all these different sliders and things to adjust the amount of compression. Some shots need very little adjustment and some shots look exactly as they were rendered. And some just degrade seriously. Then we go back in and, if necessary, adjust the art to alleviate some of the degradation.

How many techs are working on *Rebel Assault II*?

We have two full-time visual effects technicians, Aaron Muszalski and Doug Shannon, who are just doing SMUSHing, and we have another, Chris Weakley, who is half visual effects technician and half video effects technician, working on the video stuff.

Better is Better

In terms of art, why is *Rebel II* superior to *Rebel I*?

It doesn't matter how long it takes for you get to a finished image or final animations because you still end up with the same thing at the end. It's still a 256-color animation that you're playing. In the first game, we were limited to 16 colors for the backgrounds on the playable sections, and that was a hindrance. Most of it was an experiment and we didn't know that it was going to be a big hit, so we couldn't justify to anybody that we had to do this and this and this to make it good. There had been no precedent that had been set. But for the second game, it was much easier to say, "We want to make it this much better, and here are all the improvements we can make, and here's what we need to do to make it better." Specifically, we were able to say no more 16-color backgrounds for the playable sections. So all the backgrounds are now 256 color. It really takes the images one step closer to realism than what was in the first game.

What's your favorite level in the game, other than your own?

[Laughs.] Mine isn't far enough along to even make that call. I'd say probably Level 2. The rookie crashes on the planet, and he's running around the interior of the base trying to track down the freighter the Empire has captured. People really seemed to like the on-foot level in the first game, where there is actually a character right there rather than just being a point of view in a cockpit. And that stuff in this game just goes way, way beyond what was in the first game.

Eric Ingerson did most of the artwork and animation for this level, and it's just this absolutely beautiful, moody, grimy, industrial base way on the outskirts of someplace — where you get sent if you piss somebody off. He had this great look about the place where it's dark and dingy, a little bit foreboding. There are these big mining cars that rumble through the scenes. The death scenes in the latter part of that are some of my favorite things in the game. It looks like a subway station and there is the platform above this trench. He put these cables across the bottom that just looked cool at first. But when the stormtroopers died, there was always this problem of how to get rid of the bodies. You don't want them to just fall backward and disappear. So we were just kind of joking: "Well what if they just fell forward and these are like high-tension wires that work like a bug zapper and the troopers just got zapped." So he did it. And it's great.

REBEL PROFILE

LLESLLE ACLARO
Production Coordinator

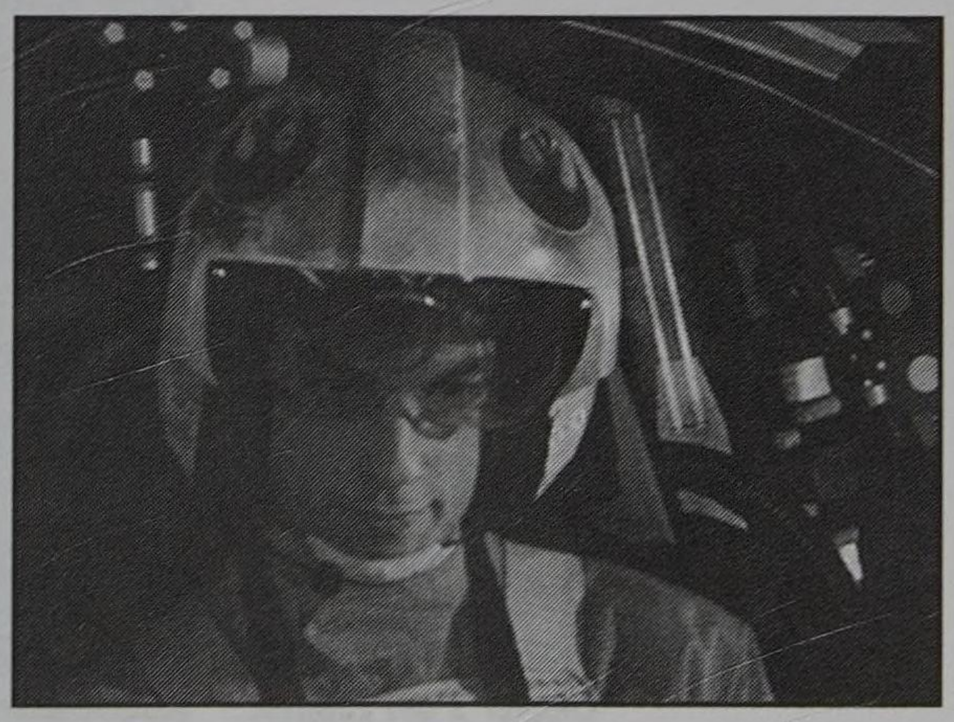
Llesll e Aclaro

So you've seen *Star Wars* a billion times and now you wanna work for George Lucas, huh? OK, here's your first job: Take these 1,000 pieces of art, all in various stages of completion, and make sure they get from artist to programmer to project leader to lead artist smoothly and seamlessly. Oh yeah, and make sure they're done on time.

That's the task Llesll e Aclaro inherited, and her work has resulted in a new job position at LucasArts.

Her road to LucasArts began long, long ago, in a theater far, far away. She saw *Star Wars* when she was 12 and resolved then and there to someday work for George Lucas.

Nine years later, as a senior finance and accounting major at the University of California, Berkeley, Aclaro applied for and received an internship at



Close-ups are much more realistic in **Rebel II.**

REBEL PROFILE

LLESLLE ACLARO
Production Coordinator (continued)

LucasArts. When she graduated, she kept knocking on LucasArts doors until one opened. She became the lead art technician on the game *Full Throttle.* Her job was to make sure that the 2D illustrations and 3D animation that were being done for the game were compatible with the file sizes and formats that the programmers required.

While processing reams of original art, Aclaro, now 23, created a system for organizing the flow of this work from artist to programmer. Until then, there was no system, and it was easy to duplicate work or have it fall between the cracks altogether. She didn't know it, but she was creating a new position at the company called production coordinator.

When her work on *Full Throttle* was completed, the *Rebel Assault II* art team was ready for her services. "The amount of stuff we had to track in this game is amazing," says designer and programmer Vince Lee. "Look at the storyboards. There are 500 panels here. And each one corresponds to a shot that has to have a background and a foreground element."

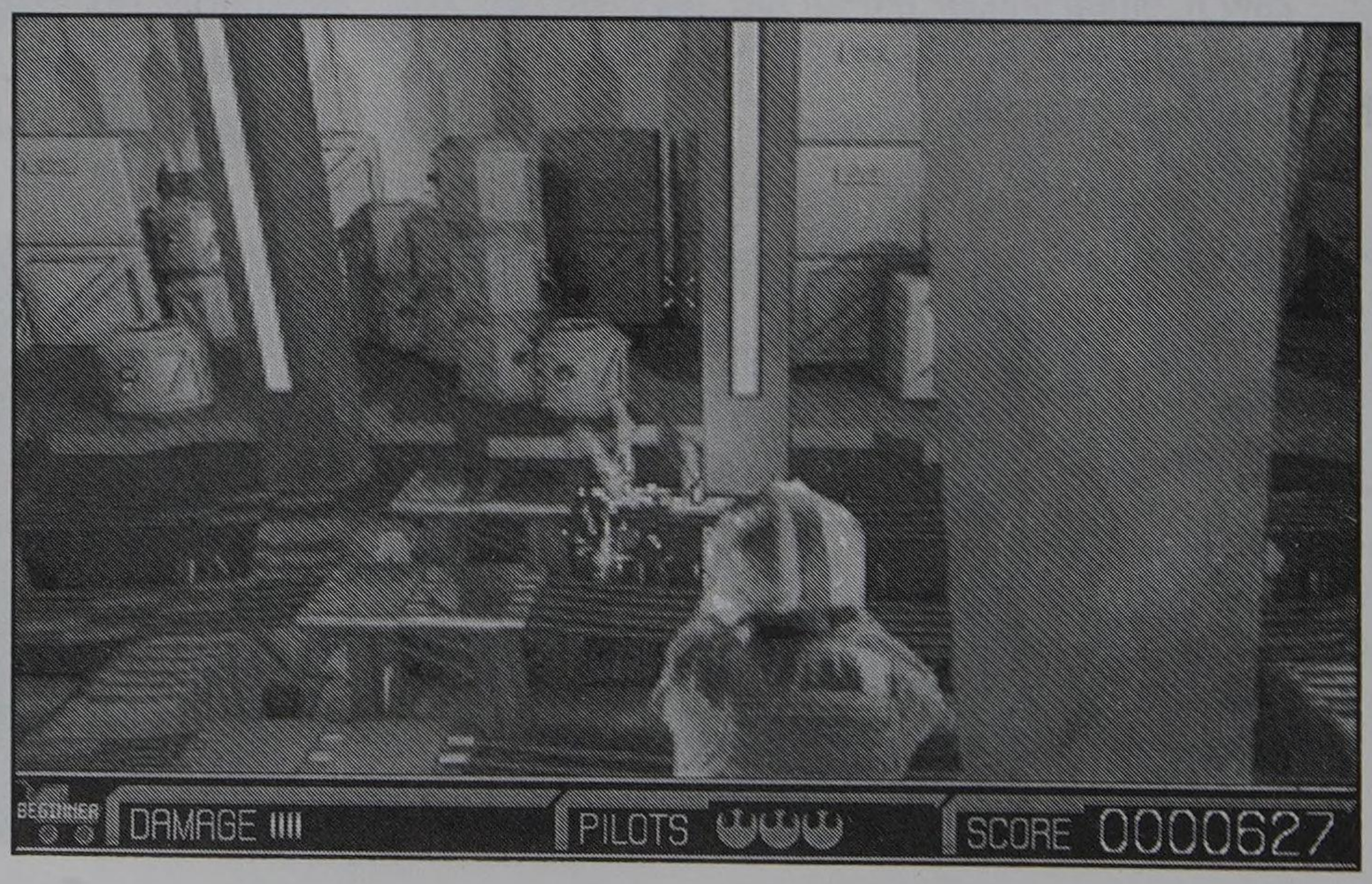
Aclaro set to work, assigning a number to each shot or frame of the game, then tracking them as they moved from each stage of production. For

Spanking the Video

What was the most challenging part of the project for you?

The video. Because we had kind of done all the 3D art before in the first game, we knew what was possible. It did get a lot more complicated this time, but it wasn't like we were unsure that it was going to work. It was just a matter of getting through it. But a big question at the beginning was that we really didn't know how the video was going to work. The biggest question was how we were going to do the cockpit shots of the pilots. In the first game, they actually took pictures of people and scanned them into the computer and then drew over that to make these very drawn-looking characters. This time, we looked at how they shoot pilots in the *Star Wars* movies, and the pilots are always moving around, and the ship is rocking around. And we thought, "That's what we need to do if we're going to show pilot shots." And then we thought, "How in the world are we going to do that?" Do we build a set and stick the pilots in it? Or do we shoot them still and then stick them against a still background and then just flip the whole background around?

What we ended up doing was a test which was the most invaluable thing that we did on the project. I'm so



Stormtroopers in Chapter 2 get zapped.

glad we did it. We shot a really crude, quick test. We went down for three of four hours in a little blue-screen stage nearby and built this rig, a platform with a chair that sat up on an inner tube. It had these handles on it and you would sort of rock it around, and we'd stick a guy in a pilot's suit on top of that. And it looked really silly when we shot it, but it looked great on the image.

But now the big problem was, OK, we've moved the guy around, now we have to move the background around to match it. And we had no idea if that was even possible. The background, the seating area, would be 3D and have to move in tandem with the video. The lead video effects compositor on the project, Mark Christiansen, and I would look at each other and say, "Yeah, well, we think we can do it. Let's try it and see what happens." So we did the first test with the pilot moving around and people were just blown away by it. I was stunned. I thought it was so great that we could do this. People see it and they don't even know it's 3D because it looks so much like a real set. People would assume we must have used the X-wing set from the movies and then shot the pilots in it. But it's all 3D composites.

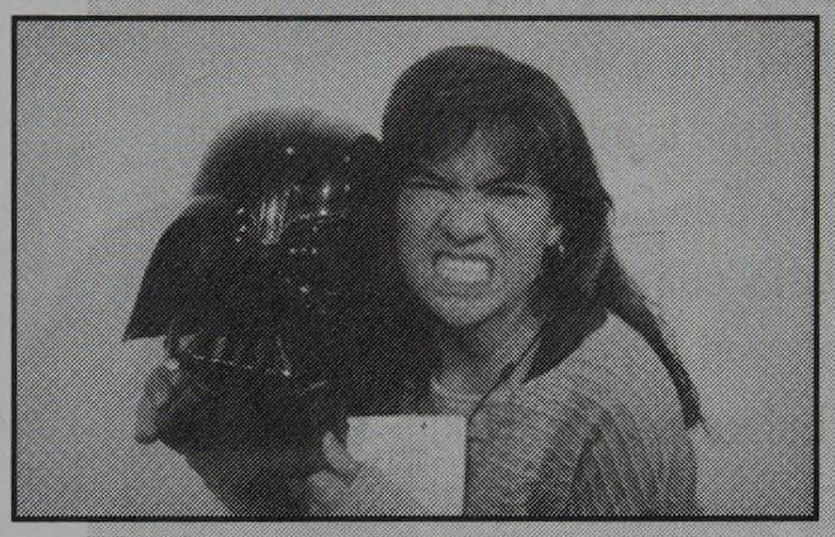
Who figured out how to match moving pilots in video with moving 3D backgrounds?

That was Mark Christiansen, the video effects compositor. It's been a big job. It was a major new position that we had never had before on any project because we had never done extensive video before. He thought he could do it and I didn't really know much about it technically, the software that he was using. But after the test, everyone was thrilled with it so we figured we were on the right track.

REBEL PROFILE

LLESLLE ACLARO
Production Coordinator (continued)

example, when a piece of 3D animation was finished by an artist, she routed it to lead artist Rich Green for approval. She would write detailed notes about the work to the art technicians (her old job) so that they could most efficiently SMUSH them down to the proper frame size, and then she would pass the final art on to Lee with more notes describing exactly how the art had been processed. Of course, with 500 shots to lord over, most of this takes place on an in-house computer network so that anyone at anytime can find what they need. Did things still get lost or



Llesllе puts on her "get it done now" face

confused? "Sometimes." Aclaro says, "All this is very new. It's still tricky. But we're getting better all the time."

Lead artist Green is more specific about her contribution. "Without Llesllе," he says, "I don't think we could have ever finished this thing."

Christiansen synced the background to the pilot.

How good are you feeling about the quality of the art in *Rebel II?*

I'm feeling better and better about it as we go along. We just signed off on a couple of big levels that have been in production for quite a while. I get excited about how beautiful some of the levels are. All of our main 3D artists, Ron Lussier, Dan Colon, Craig Rundels, and Garry Gaber, have really put a tremendous amount of effort into their levels and I think it shows. I hate to speak about things beforehand, but I hope that it really blows away everything else that's out there. When I start seeing that kind of quality coming out, it keeps me going through this last difficult finishing period.

The finish line is close. What's your next project?

I don't know yet. It's going to be a big vacation after this, I can tell you that, because I haven't had one in two-and-a-half years. I don't know, I'm toying with the idea of doing my own project, my own design. But there are a lot of questions to be answered about that. It's all up in the air, but that's what I'd like to do.

CHAPTER 7

THE SOUND AND THE VIDEO

The Sound and the Video

With the advent of CD-ROMs, production requirements and costs for computer games are soaring. The days of the lone programmer working into the wee hours of the night on his arcade opus are gone, at least for the big software publishers like LucasArts. CD-ROM means video. Video means actors, directors, crews, sets, costumes, props, and all manner of expensive movie-type condiments. Access Software had to build an entire movie set in Utah to shoot the video for its sequel to Under a Killing Moon. *Sierra On-Line spent millions on a blue-screen studio, and it's rumored that Origin spent $10 million on its latest incarnation of* Wing Commander. *So one would think that Lucasfilm, the only company that has a successful track*

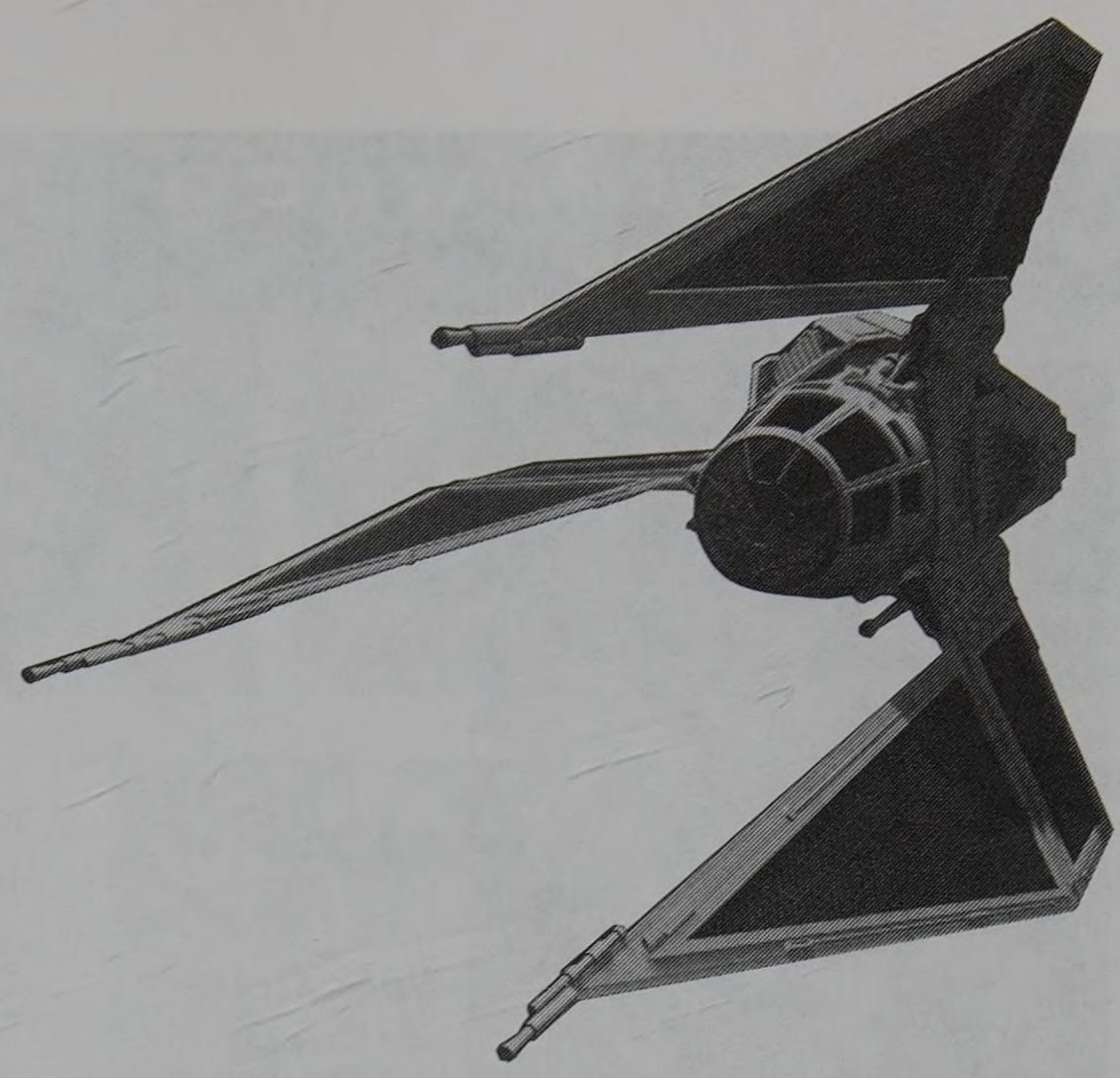
record in both movies and computer games, would be right in the thick of this production escalation. But not so. The LucasArts development teams avoid budget busters like the plague. In fact, they pride themselves on making expensive-looking computer screens inexpensively, while many upstarts in these pioneering days of CD-ROM are spending big bucks to crank out the computer equivalents of Hollywood B-grade films. *Rebel Assault II* is the perfect example of how you can get something from relatively nothing — not an easy thing to do when the expectations of *Star Wars* fans are anchored in hyper-expensive, state-of-the-art film technology that most game developers can't touch.

When it was decided to incorporate live-action video into *Rebel Assault II*, the temptation to loosen the purse strings must have been powerful. After all, this is *Star Wars.* You can't have video footage that looks like something Joe Bob Briggs ogles in a Texas drive-in. LucasArts could have thrown a lot of money at the video and saw what stuck, but they followed a different path. First, they thought a lot about what the role of actors and dramatic scenes should be in an action game like *Rebel Assault II.* They arrived at a definite conclusion: Actors should tell the player what they need to do as quickly and dramatically as possible, then they should shut up and let the player get on with it. If in movies the rule of thumb is "show me, don't tell me," in games it's "tell me, don't show me" because players want to do it, players want to make things happen.

Secondly, the development team knew its limitations. Getting good video takes experience and know-how.

Getting good video on the cheap takes extreme experience and know-how. Video shoots are like cab rides; the meter is always running, so it's best to not just cruise around hoping that you find where you want to go. You want a driver who can speed from point A to point B efficiently and, if possible, elegantly. In *Rebel Assault,* Rookie Ones are able to perform miracles in high-speed space shoot-outs, but you can't save money or get quality footage on a video shoot with rookie directors. The price of learning "how to" is too high.

Fortunately, LucasArts can turn to an in-house expert in such production matters: Hal Barwood, a 20-year veteran of the Hollywood star wars. As a pro-fessional movie screenwriter, director, and producer, he knew exactly what was needed to get the footage that Lee and his team scripted. More importantly, he knew how. This chapter tells the story of the "new stuff" in *Rebel Assault II* — the video — and the "old stuff" — the John Williams music from the *Star Wars* trilogy. It's the story of the "unknown factor" that looms in every game. In *Rebel I*, the question was if and how you can stream 3D animation on the fly. In *Rebel II*, the question was if and how you can get *Star Wars*-quality video on a computer-game budget. Hal Barwood explains how they did it.



EXPERIENCE MEETS YOUTH

What was your role in the development of *Rebel Assault II*?

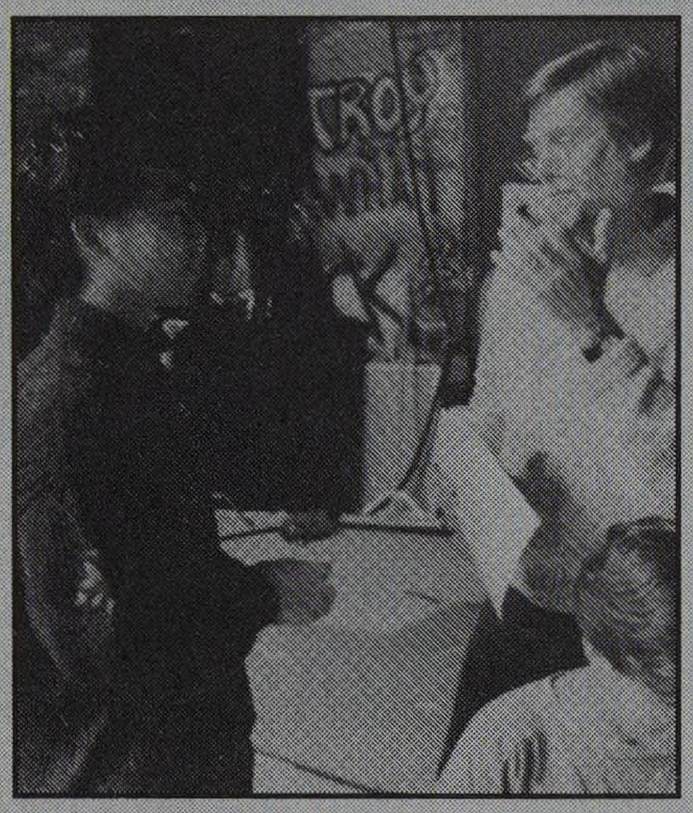
I'm a game designer and a project leader like Vince [Lee], but I have nothing to do in that respect with *Rebel Assault* and *Rebel Assault II.* The reason I'm involved in *Rebel Assault II* is that before I started professionally working on games, I was a movie writer and producer and director. I have a longtime background in film. So I'm simply a guy for hire. I'm a big admirer of *Rebel Assault* and I'm very, very interested in seeing us move into video production and incorporate video into our games. It's an area that I feel very comfortable in and want to exploit, so I jumped at the chance to be able to get involved and help these guys out some.

I've always watched and marveled at Vince because he doesn't have a film school background but he has an intuitive grasp of editing and shot construction. So it's fun to see him to stumble his way a little bit toward a very solid grasp of how film making works. I watched *Rebel Assault* get made with a lot of interest, and it's one of my favorite games. I've played it extensively. So I thought it would be wonderful to have a chance to help them move from the kind of static art that was used in the first game, with little characters with moving mouths, to full-motion video in *Rebel II.*

Is that the major difference between *Rebel I* and *Rebel II*?

Everything about it is just more ambitious. The 3D modeling is more amazing, the settings are more complex — there's one sequence where you're flying through this mining machine in the middle of an asteroid [Level 6]; it's just dazzling. But I think the big jump is from the 3D modeling, which was already being done in the first one, to full-motion video.

HAL BARWOOD
Video Director



Hal Barwood and Vince Lee on the set

Hollywood's migration into cyberspace has become the newest manifest destiny — "Go CD-ROM, young man!" — but long before it became vogue, there was screenwriter, director, and producer Hal Barwood and his Apple II computer.

Barwood, 55, worked in Hollywood for more than 20 years. With a friend and longtime writing partner, he wrote *Sugarland Express,* Steven Speilberg's first feature film. He co-wrote and produced movies such as *Corvette Summer* and *Dragonslayer,* and he directed *Warning Sign,* what he calls "the first of the biological thrillers." He came to LucasArts in 1990 to produce the graphic adventure *Indiana Jones and the Fate of Atlantis.*

But even while he was making hay in Hollywood, Barwood nurtured his lifelong passion for games. "My interest in games predated my interest in movies, actually," he says. Growing up in Hanover, New Hampshire, (home of Dartmouth College) in the 1950s, he designed paper games and an "electrical" football game that became very popular among his friends. Unfortunately, there weren't many career opportunities for game designers when he was graduating from high school, and the arrival of personal computers was still two decades away. So he went off to USC Film School (George Lucas was there at about the same time), and his game-design skills went into hibernation.

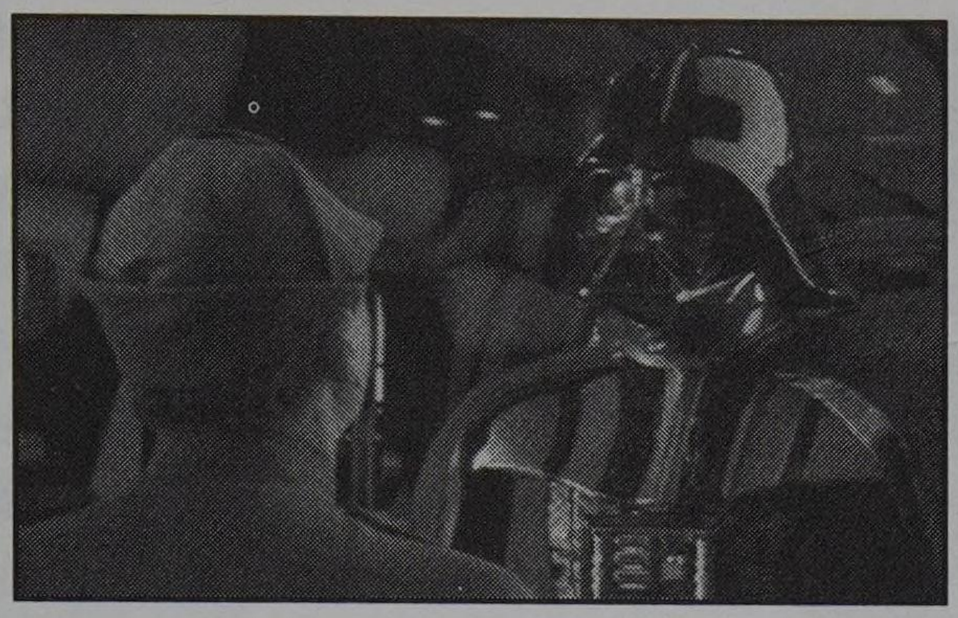
"You can tell from the color of my beard," Barwood says, "that I grew up in an era when computers were these large things that occupied giant rooms that were specially air conditioned and attended by these acolytes in white coats. No one like me could get near a computer."

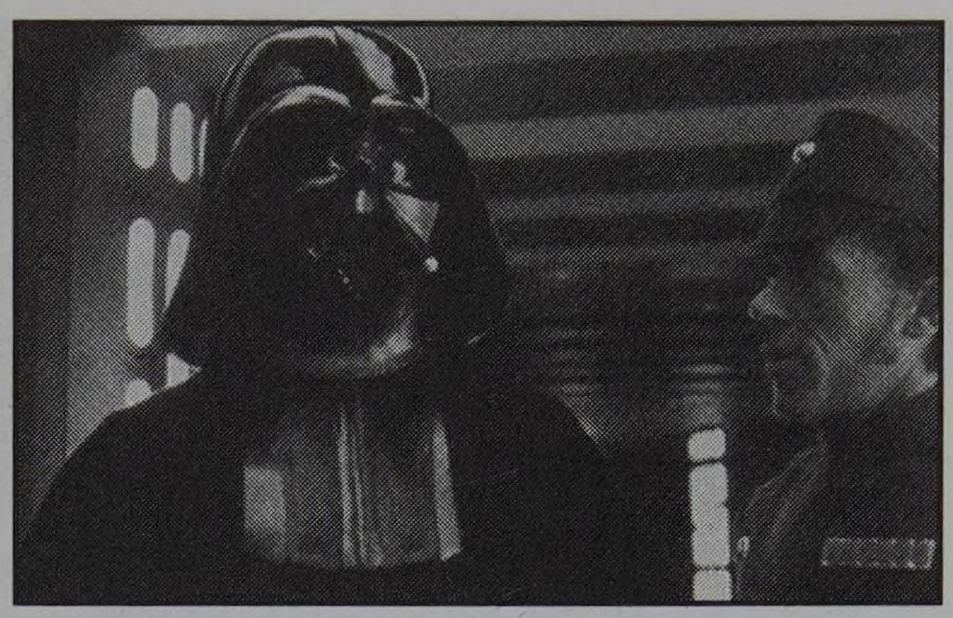
But you can't keep a true gamer down, regardless of the current state of the technology. In the 1970s, calculators that you could program started to get his attention, and then in the early '80s, he was caught up in the Apple revolution. "I got very excited when computers became something that an individual could have," says Barwood. "So for the last years of my active movie career, I was also teaching myself on the side how to program and how to design games."

On his trusty Apple II, he created *Space Snatchers*, "what would now be called an action role-playing game. I used it to teach myself Assembly-language programming. You get kidnapped at the beginning by some aliens, and the trick is to free yourself from the aliens and get home. It's a very long, complex graphic adventure on a wonderful, antique machine."

His next design was a model railroad system for the Apple II called *Binary Gauge* in which you design sections of a railroad merely by painting them on screen. "The little trains knew how to find the painted track and follow it," Barwood says with enthusiasm. "It was really pretty cool. You had switching engines and you could park cars all over the place. You'd have these vast railroads that were good for operation but which actually reduced the look of your models to just squares. But I got very excited about it."

It was these early designs that introduced him to LucasFilm Games, predecessor to LucasArts, in the mid-80s. "I got to know the early people here at Lucas," he says, "although they've all vanished





***A Rebel Assault II screen and a still shot from* Star Wars**

THE PERILS OF FULL-MOTION VIDEO

What's the biggest challenge with full-motion video on computers?

The big problem is performance. By this time, with the Pentiums, we've just about swatted the word processing problem. Computers are definitely fast enough to do word processing. And they're pretty good at doing the complex calculations needed to do spreadsheets. Nobody seems to complain about performance problems with those. But computers as conceived to solve those kinds of problems just didn't aim high enough to solve the problems of the presentation of complex visual material. Computers are really anemic when it comes to doing this. So you have to pull a million tricks to get a good visual presentation. And fortunately, Vince knows how to do that stuff pretty well. But basically we're pulling tricks, and it's hard to look at something and feel that it's a video experience that's attractive. It doesn't equal TV and we don't pretend that it does, but we do want it to be attractive and comfortable and acceptable.

So what do you do to narrow the gap between computer video and television or movie video?

There are two things that we're concerned about. The first thing is what we're going to do aesthetically for presentation purposes. And the second thing is how we're going to do this as inexpensively as possible. For

REBEL PROFILE

HAL BARWOOD
Video Director (continued)

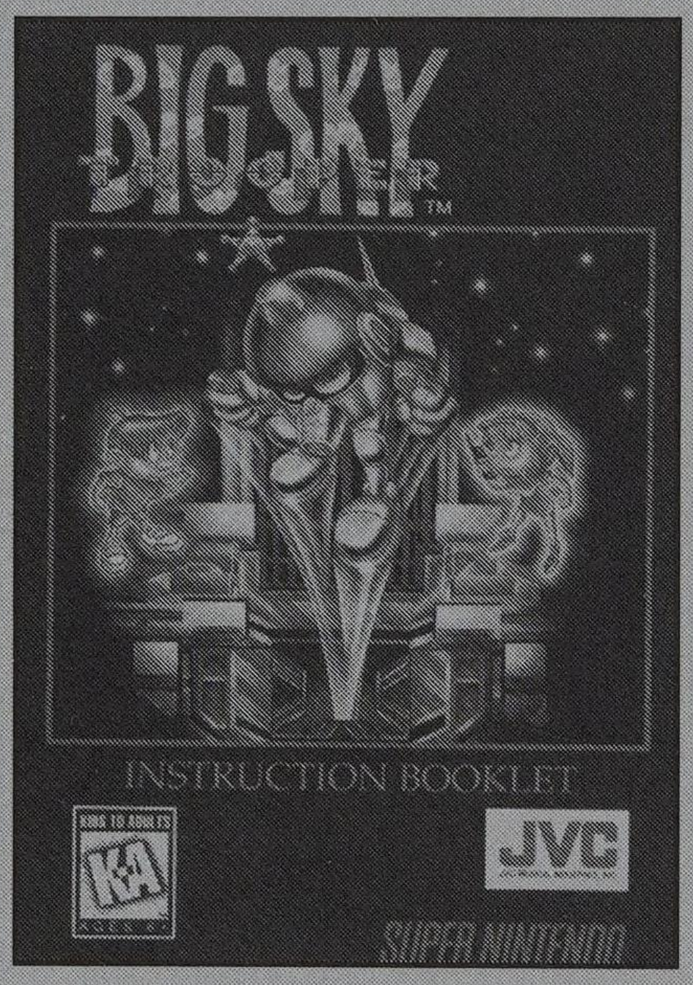
since then." Toward the end of the decade, the company made the decision to grow the computer game division in spite of the fact that the industry was going through financial turmoil at the time. It wasn't clear whether PC games were going to get bigger or smaller, especially when Super Nintendo was making its smashing debut.

But one company's turmoil can be another man's opportunity. In 1990, Barwood's path into LucasArts materialized before him. "There was a project that they wanted to do, but no one then at the company wanted to do," he remembers. "The guy who was the logical choice to be the project leader went off to do a new game called *The Dig* with Steve Spielberg. They still wanted to get this other project going, they didn't have anybody else, they knew of my interest in this stuff, knew that I was sort of competent, and they let me do it. So I did, and it was *Indiana Jones and the Fate of Atlantis.*"

In those five years, Barwood has become the grizzled veteran of LucasArts (only two people in the entire company have been there as long as he has), but he has a rookie gamer's heart and enthusiasm. His team has just completed an action role-playing game for the Super Nintendo that will be released this year called *Big Sky Trooper.* Barwood describes it as "a long, complicated game of galactic reconquest from the aliens that take over. It's a kids game, very cute and sweet, but it's very, very complex."

HAL BARWOOD
Video Director (continued)

Barwood has also invented a new genre of computer game called desktop adventure. The first of its type, which will be released later this year or in early 1996, is called *Indiana Jones and his Desktop Adventures*. "It's a tile game and a story game that can be completed in about half an hour," Barwood explains. "Indy is in Mexico, and your job is to prevent the looting of Mexico of its famous treasures. There are about 15 different terrible things that can

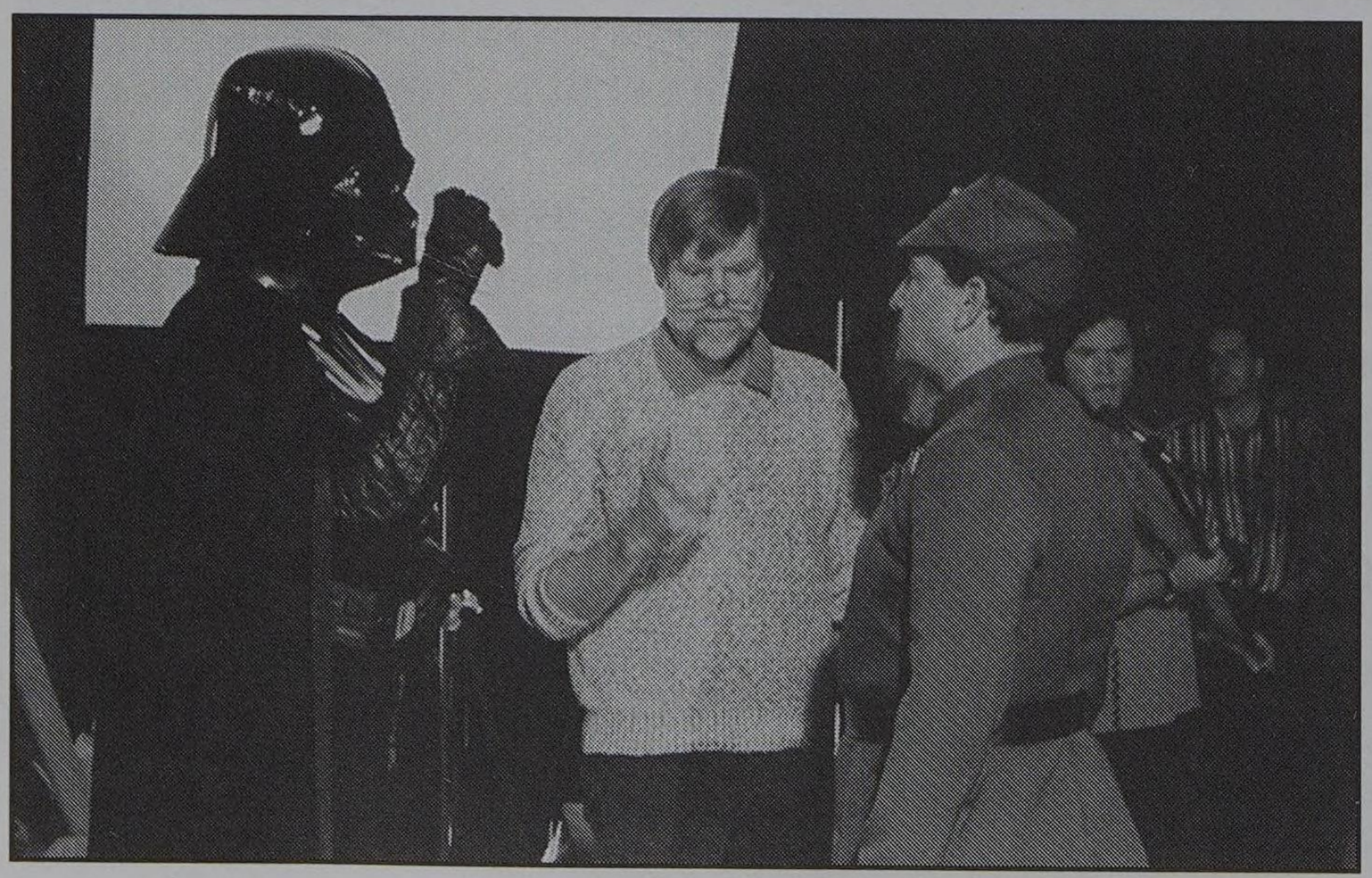


Big Sky Trooper will be out on Super Nintendo this year.

the first one, you have to be a bit careful about doing abrupt cuts. Luckily, I didn't have to worry about that because I was just shooting actors against a blue screen. That's mostly what I did. But you still have to think a little bit about motion.

The other question, the budget question, means that we don't build any sets. Everything we do is 3D modeled. And we take great care to organize our video production in such a way that we take the best advantage of that. And that takes serious thought. Luckily for us, since this is a *Star Wars* game, we can go get these national treasures, which are the costumes from the actual *Star Wars* films, and outfit our actors in those things. When they're actually working in those things, they don't seem so much like national treasures as a pile of junk and rags, but nevertheless the effect is of complete authenticity. And that's wonderful. We don't have to build our own costumes.

From the budget point of view, the big problem I face is that I can't move the camera very much. Normally if I were blocking a scene, I would block it in a way that this little camera dolly would be going all over the place. You try to do things in an organic way so you don't have to do a lot of coverage shots with a lot of edits. My kind of style of directing is to figure out the



Hal instructs Darth Vader and Admiral Sarn

way the scene will unfold and then have the camera move around a lot to follow it without having to resort to a lot of over-the-shoulder shots or punch-ins for close-ups and so on.

REBEL BRIEFING

"Blocking" means laying out blueprint or script for where and how the camera and actors move in a scene.

My instincts are to do it that way, but with computer games, you're challenged by the prospect of figuring out how to get that sense of movement just with cuts. So what that means directorially is you have to throw everything to the movement of the actors. You have to make sure you can bring them in and out of shots so you can find a lot of good cutting points — and then you can do it all statically. If you can't move the camera, move the actors. And that's a big challenge.

Why can't you move the camera?

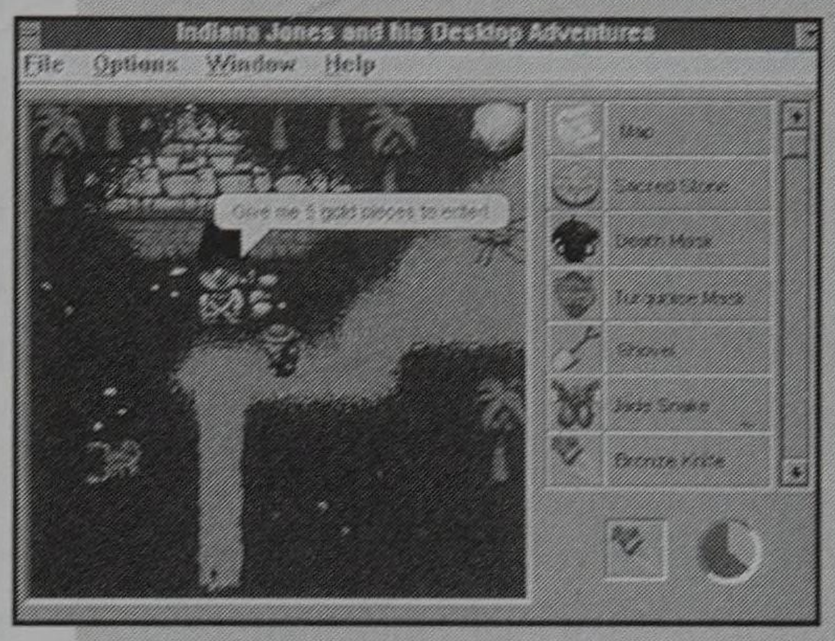
Eventually we may be able to read out camera motion digitally and then use that information in a 3D modeling program to keep changing our witness point. But at the moment, the technology is not there to do that. So I have to be able to shoot the scene from exactly the point of view that we're going to render it. As

Ru Murleen and Rookie One in front of the blue screen.

REBEL PROFILE

HAL BARWOOD
Video Director (continued)

happen, and there are about 10 to the fifteenth power possible ways that you can solve each problem. Mostly it's a series of puzzles, but they are puzzles of great variety, and they get rewritten in different ways. The idea is to do in kind of a story way what chess does in that you have familiar elements that get re-used in novel ways. I'm doing it with a very small team on a very short development schedule, and we're going to sell it for 15 bucks."

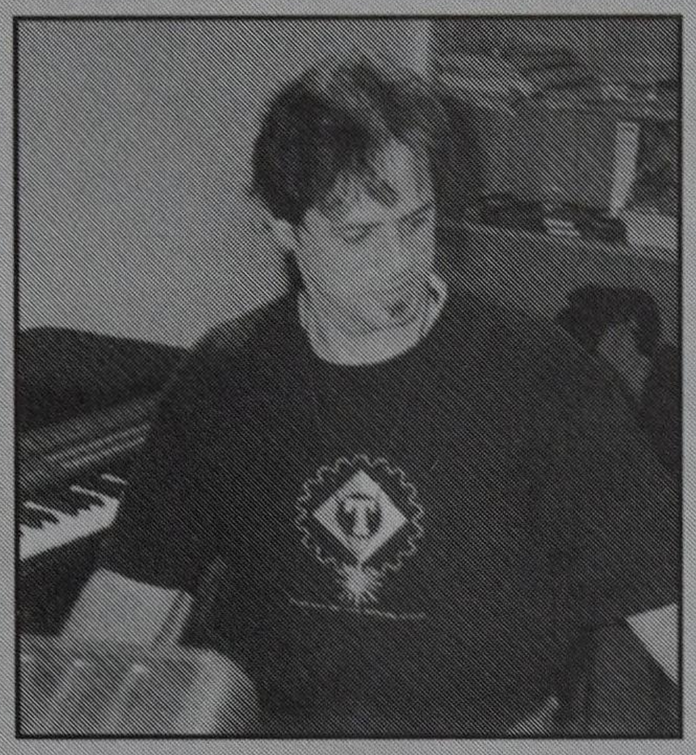


An early screen from Indiana Jones and his Desktop Adventures

It took more than 20 years, with a long side-excursion through Hollywood, but Barwood finally feels at home in the brave new world of computer entertainment. But it's not movies on computers that he wants to create. There's something about gaming in his soul that has taken him from electric football to Apple II pixels to full-motion video on CD-ROM. "I'm actually interested in games that look like *Indiana Jones and His Desktop Adventures* as games that have video in them," he says. "But I'm particularly interested in games that tell stories. That doesn't mean that they have to look like video. Indy tells a story and looks like a cartoon and is very toylike. That appeals to me. *Big Sky Trooper* is even more toylike. Very cute. And *Rebel Assault* is *Star Wars.* I'm just interested in games."

REBEL PROFILE

LARRY THE O
Sound Designer



Larry the O

With most thing, seeing is believing. But with computer entertainment, you have to add hearing to the mix. Sure, you can see a beautifully rendered scene of deep space, but if you hear canned sounds of cows mooing, you're just not going to believe in that environment. In *Rebel Assault II*, Sound Designer Larry the O and Designer Vince Lee collaborated to create movie-quality sound effects that make the game's interactive illusion of space combat come to life.

The O helped Lee create "an overall feel" for different areas in the game, as well as create specific sound effects. "In the past, the technology for games did not allow you to have many sound effects," the O said. "Now it's possible to do much more in the way of sound effects and music, and the whole trend here in terms of sound is going more and more toward a cinematic approach — creating a general atmosphere so that you are totally immersed in the experience, just like a film. Pete [McConnell, *Rebel II* music director] always says that our objective is to have somebody who is in the next room while you're playing one of our games think that you're watching a movie or television, not playing a game."

The O should be able to help with that. He was an assistant dialog editor on the movie *The Thin Blue Line*, cut new music to fit the original Gumby cartoons, and worked as a sound editor and designer for the ABC Saturday morning animation series *Bump in the Night*. When several colleagues from the sound department at LucasArts told him they were looking for someone to bring a more movielike approach to game sound effects, he jumped into the game world for the first time.

Rebel II was his first computer game, and he had to adjust to production differences between movies and games. "I was used to television and film where you have a script, you have a director, you have a production schedule with absolutely immovable deadlines.

"Obviously there are deadline pressures here, too, but there are a lot of things in a game that can't be tied to a schedule, and some things that are just downright ineffable. It's such a young industry compared to films that there are very few established ways to operate. A lot of times you want to know how to do something and there's no one that can tell you because it's never been done before. So you have to figure it out for yourself. That's very exciting, but it's also very difficult."

Fortunately, the O had Lee as his mentor. "I was very lucky that in my first project I was working with Vince because if I leave a little more slack here and there than I should, he takes it up like that," he said, snapping his fingers. "I'll give him sounds, and the next day some of them will be in the game and with new video I've never seen before. It's amazing how he pulls all the pieces together and stitches them up."

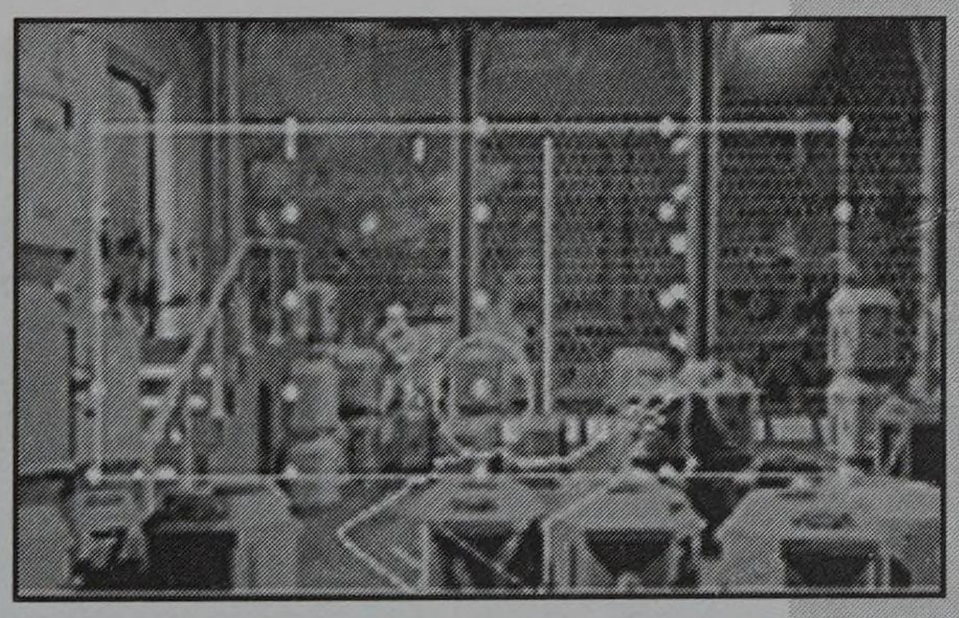
Some of those pieces were the O's special effects, which he divides into three categories. The first is "correct and proper and traditional" *Star Wars* sounds. "Obviously this is a *Star Wars* game," he said, "so if a TIE fighter flies by, there are enough people out there who know what that sounds like. For those kinds of sounds, we have a library of effects that we get directly from the vaults of Skywalker Sound. Sometimes I'll have to modify them for a little variety, or perhaps for context. For example, a TIE fighter flying through space is one

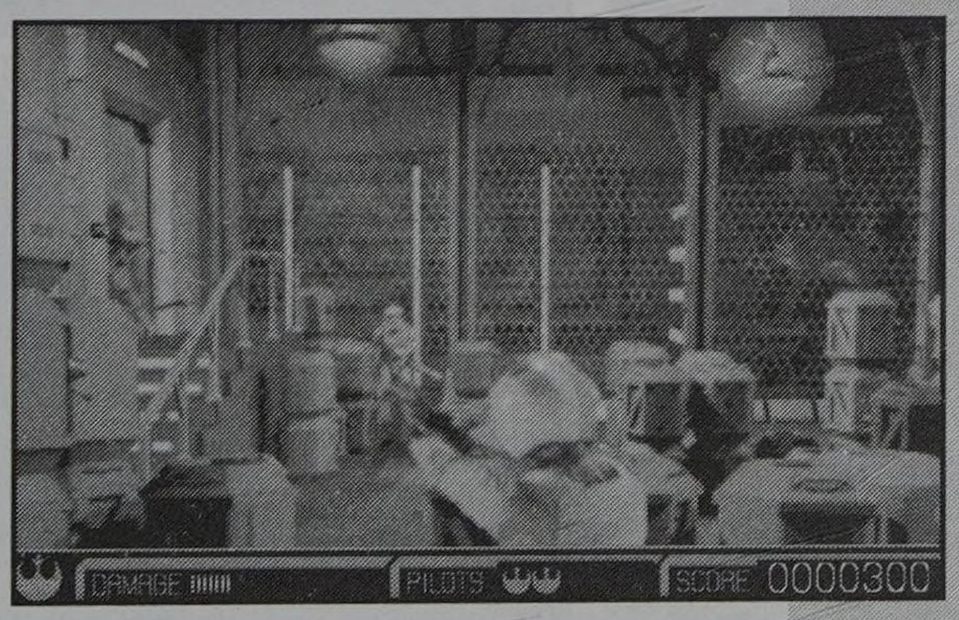
soon as you start to move the point of view, the actor just skates off the existing 3D background.

Can you give an example of how you shot a scene in *Rebel II*?

It's not my favorite shot in the show, but a good example of something that's truly exotic is the sequence in which Rookie One pops out of some rocks outside on a desert planet [Chapter 2], hops down out of the rocks, runs into a doorway into an interior, and then runs off into the interior. You're doing a big lighting change as he goes through and shoots a couple of stormtroopers as he passes by them. It's all shot from a static point of view, and we're going from outside to inside, but actually on the set it's all just blue. There's this guy and there is this sea of intense blue. We built stuff for him to run down this slope. But basically it's all just blue. So how do we deal with this?

On the set, we have a prerendered version of that background. And we have an Ultimatte on the set, which is an electronic device that can take as an input





In order to get Rookie One's shooting angles right in this shot, artists superimposed his positions over a 3D background. Barwood then filmed the actor in those positions.

REBEL PROFILE

LARRY THE O
Sound Designer (continued)

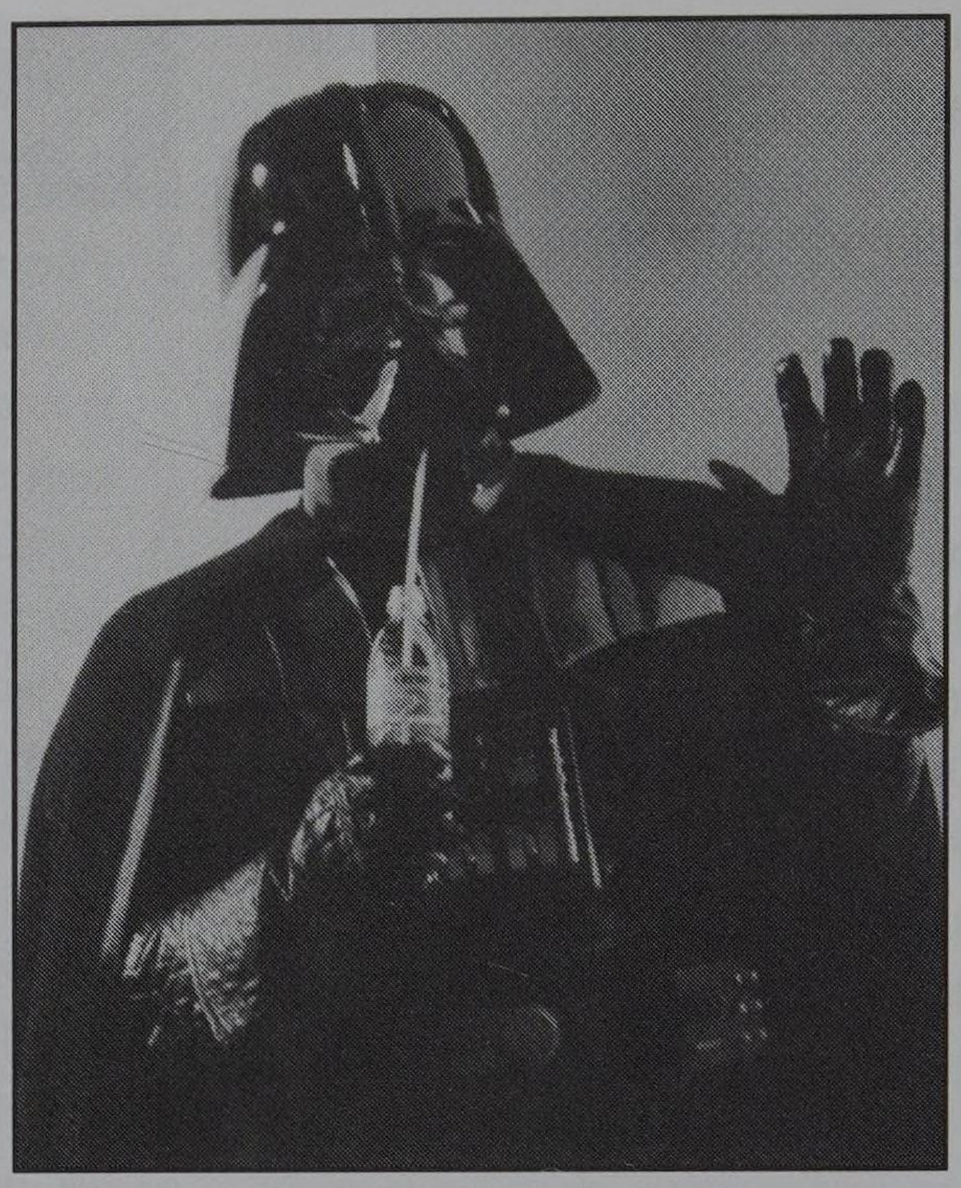
thing, but if it's flowing through a corridor inside a space station, you might want to add some sort of processing so that it sounds more like it's inside this huge steel tube."

The second category is effects matched to specific actions. "For example," the O explained, "when Rookie One reaches down and pulls up a lever to eject because he's about to crash, we needed to have the sound of that lever. I just took a little case with a latch on it, recorded the sound of the latch clicking, and then pitched it way down to get a big, deep, sharp sound. The thing I find in the *Star Wars* universe in general is that you take a lot of real-world sounds and pitch them way down because everything in the *Star Wars* universe is huge."

The third category is hybrid, atmospheric sounds that the O had to create from scratch. "There's one scene where a train comes through," he said. "Obviously you don't have your regular clickety-clack tracks in the *Star Wars* universe. It's going to be something closer to a BART train [an electric train in the San Francisco Bay Area that glides on tracks]. You have to try to come up with something that fits within the context of *Star Wars*, yet that doesn't exist in any of the movies."

To create the futuristic-train sound, Larry the O followed a George Lucas tradition — use real, unsynthesized sounds as source material. "In the original *Star Wars* movies," he explained, "George Lucas told his sound designer to use all naturally occurring sounds, or acoustic sounds, instead of synthesized sounds because they tend to be richer. So we tend to adhere to that. Most of what we use to create our sounds are real sounds that we either get from a library or record ourselves. For the train, I used a couple of different real buzzer sounds and combined and

our computer signal — which is the prerendered background — and combine that with the signal from our video camera. I get to see it on a monitor and I can see our character running around. I use that to figure out how to make the perspective work. You walk the actor around the set and you see if you're participating in an exploratorium illusion, or does it suddenly look like he's in that set? And you can adjust the angle of the lens, the height of the camera, and other things to lock him in to the correct frame size.

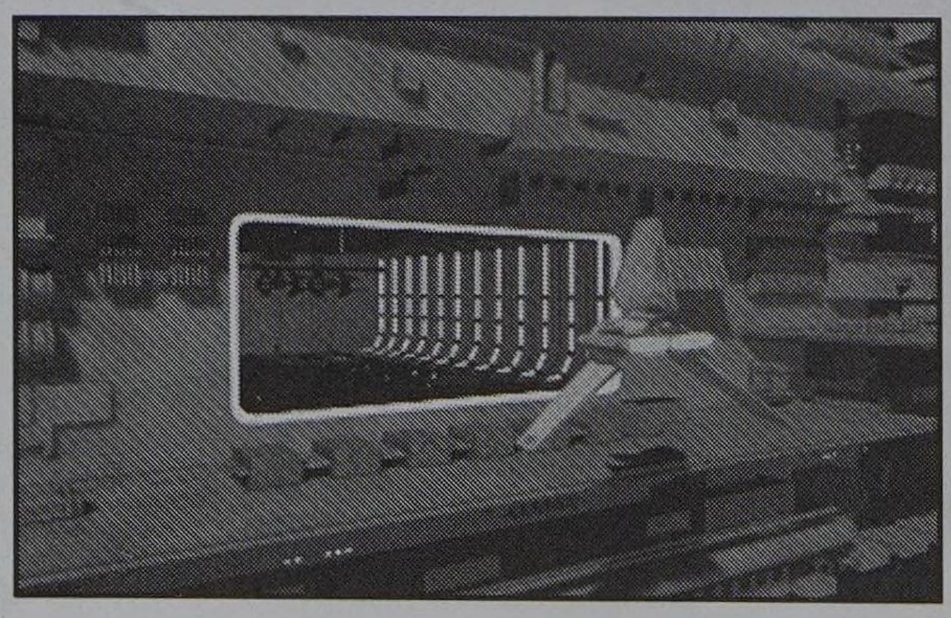


A thirsty Darth on the set

Was every scene, then, shot with a static camera?

We do some camera motion. We do. There's a wonderful scene in which a *Tydirium* shuttle comes flying overhead, its wings start folding up, it sweeps down to land, and the camera appears to be moving downward as it's doing this. And you find out that this thing is going to land on a big platform that's elevated on giant pylons way above your point of view. And as you pull down to reveal this platform, you're also seeing a pair of actors in the foreground who are watching this thing happen. Well, part of that tilt is done in 3D modeling, and part of it I did. At first the actors aren't moving; we're just sliding them up into

Rookie One gets ready to make his move in Chapter 2.



***A rare instance of camera movement in* Rebel II.**

frame. And now they look at this ship and they crouch down behind a wall to discuss what their next move is going to be. What we did is shoot them statically, knowing that the 3D guys in post-production would slide them up in frame as the shuttle comes down. And then when they crouch, we also slide another element — a wall element — up in frame, and we did a very fast pan. The idea is not to spend too much time at it. A long, slow pan is very, very hard to match with the 3D background. But if you do something that's kind of whippy, and they're aren't too many frames, nobody can tell. So we do move the camera, but it's rare and we have to consider it carefully. From my point of view as a video director, I have to be in a position where I know the limitations and capabilities of every phase of the production process. I know what Mark Christiansen [video technician] can do and I know what Richard Green [lead artist for 3D animation] can do and I can put those things together in a way that will work. Also I can do my elements in a way that will

The pilot against the blue screen, then with the cockpit and base added

REBEL PROFILE

LARRY THE O
Sound Designer (continued)

balanced them in various different ways with a train pass-by."

But just as video and 3D art must be reduced in size to fit the current technology of home computers, sounds have their cyberlimits as well. After the O

The O used a latch to create the sound of Rooke One pulling the eject lever

mixes a sound to his satisfaction, he modifies it to a convenient size.

"On this game we don't use sound compression, but there is a limit to how large a sound can be. Vince, again, is so self-sufficient. Most of the tools he's using he's written himself, so he can modify them if he so chooses. If I have a special request like, 'this really needs to be one long continuous sound and it's larger than the maximum file size you told me,' I could lobby with him and he could go in and make whatever changes are necessary to the tool to allow that. But basically you have a limit, and you have to fit your effects within that and be clever. At times that means that I'll take a sound and break it up into a couple of chunks that can each function on their own, and then I'll give Vince instructions that these are intended to go in a sequence, one, two, three."

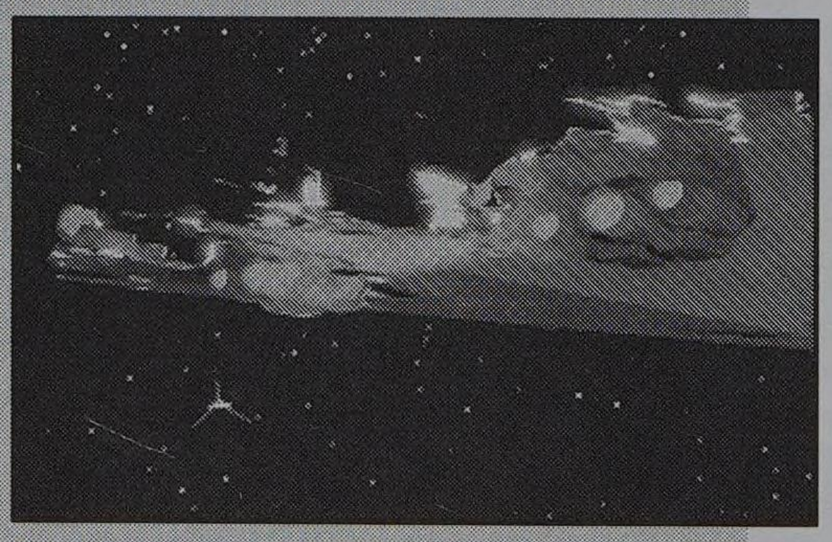
When asked to name his favorite sounds in *Rebel Assault II,* the O mentions two. The first is the sound you hear when an Imperial Star Destroyer decloaks. "I came up with a great big really deep sound for the decloaking," he said. "It starts off just sounding like

REBEL PROFILE
LARRY THE O
Sound Designer (continued)

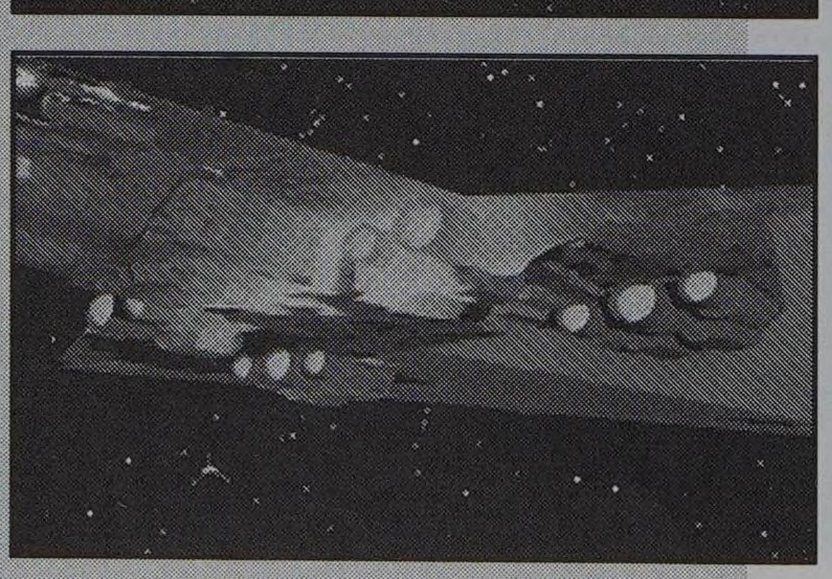
garbage, and then the garbage sort of falls away and you have this big, thrumming Star Destroyer sound. I used a variety of different sounds to get that mixed with some real train pass-bys. It's actually one of the very few places in the whole game that I used synthesizers."

His other favorite sound is the hovercraft sleds, which are new to the *Star Wars* universe. "I was combining engine sounds," said the O, "but if they're hoversleds, you think they might be doing something with air, so I actually took a vacuum-cleaner sound and filtered it, pitched it way down, and mixed it in. When creating sounds, you try not to think that it's a vacuum cleaner. You use whatever you can find that might sound like what you're seeing."

The Star Destroyer begins decloaking.



The sound deepens as the ship takes shape.



The Star Destroyer thrums to life.

fit with what those guys need to have happen or can handle without too much difficulty.

There was another place where it looks like we're moving the camera, but we're moving the actors, which is interesting. A lot of these shots — more than 60 — are pilots in cockpits at various moments in the game. They're pretty close. They're all wearing helmets and so forth. We wanted to have the look of these actors in something that is not attached to the ground. So we needed to have a bouncy look. I found out that Mark Christiansen and post-production could track a background with a moving actor using some software that he has — and lots of persistence and skill. They were trying to figure out how we were going to do this, and I suggested that we build a little rig about 6 feet on the side with plywood — a little platform — and it has some shafts that stick out from it where grips (guys on the team actually, Richard Green was one of them and Mark was one for a while) could move the platform. We built chair on top of that and painted everything blue and mounted this whole thing atop a truck inner tube. And we would sit them in front of the camera and these guys holding the shafts did a repertoire of moves. Little speed bumps and bounces and tilts and jumps. So the actors in the chair are bouncing around a lot, and they're trying to stay still, but they're just getting thrown. The result is that it feels very lively. Then Mark tracked the background so that their 3D cockpits are going with them. It's very convincing. It's just wonderful.

It seems there are more close-ups than wide vistas in *Rebel II*. Is that for aesthetic or budgetary reasons?

Well, actually, there are both. When you want vistas, you do vistas. We have a lot of very long shots. It's wonderful to see something that only exists in a computer appear to be a real huge landscape

because you have a real person walking around in it. So we do some of that by combining the best of video and 3D. The problem, of course, is that there aren't too many pixels devoted to this little character, so it's a pretty degraded image. It's true that when we want to see a lot of facial features and expressions, it's my job to take actors and get a dramatic performance out of them. So we do for fairly tight close-ups because we want a lot of information to come through. The human face is very complex and subtle, and you want to see as much as possible. It's the same kind of techniques that you use in television, but even more exaggerated.

So casting good actors and actresses is very important. How does that fit into your aesthetic-budgetary equation?

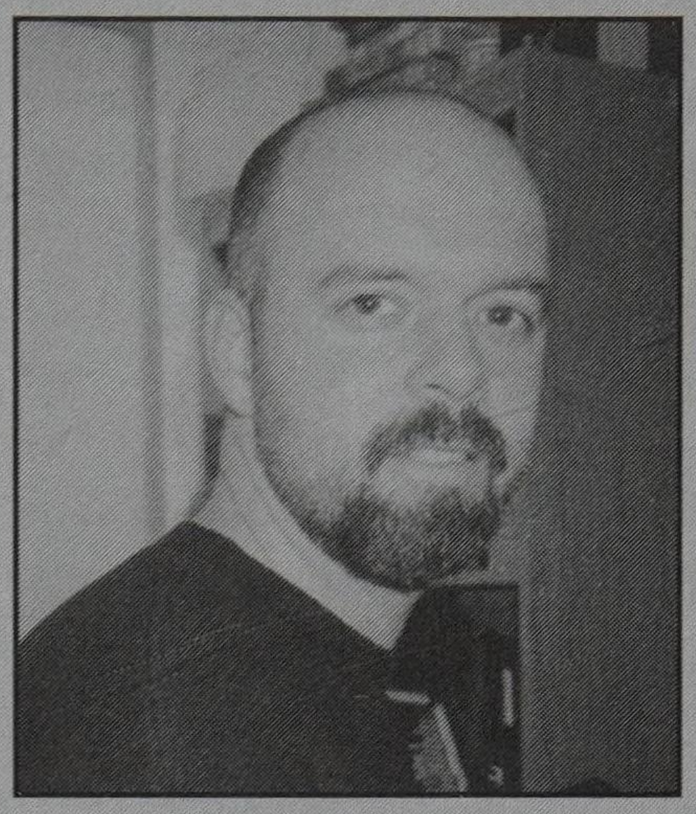
It's true that budgets would govern casting to some degree. But what really governs casting is the fact that it is *Star Wars*. *Star Wars* was never a film that was made with stars. The universe itself, that kind of fantasy world, was the star. It turned out that a lot of people who were in the *Star Wars* movies became stars, especially Harrison [Ford], but we adopted the same plan. There's a lot of talent in San Francisco. We cast in San Francisco and found wonderful actors here who play all the various roles.

How is blue-screen filming more difficult for you and the actors?

One of the things you want to do is find actors who are savvy about the mechanics of acting. I don't mean by that movie mechanics, how to be subtle, how not to blink. That's different. I just mean hit your mark. It's very important for actors to be able to appreciate the difficulties, intuitively, that I face when I'm trying to handle this stuff so that I don't find I'm in the presence of people who are holding a grudge all day long while I'm trying to get them to do things. And the people that we got, Jamison Jones and Julie Eccles, for the two leads, were

REBEL PROFILE

PETER MCCONNELL
Music Director



Peter McConnell

There's a big problem with using a typical home computer as music machine, and it's called 8-bit sound. When you listen to a CD player, you're listening to 16-bit sound, which delivers more than 32,000 different sound possibilities. But when you're listening to 8-bit sound on a computer, it plummets to just 128 sound possibilities.

"It's very small," said Peter McConnell, musical director on *Rebel Assault II*. And the minuscule resolution of most computers makes it extremely difficult to recreate in a game the soul-stirring music of the three *Star Wars* movies. But, miraculously, the designers of *Rebel II* have pulled it off — and McConnell is fast to lay credit at the feet of two superstars — Designer Vince Lee and *Star Wars* Composer John Williams.

"Musically, *Rebel Assault II* is really Vince Lee's and John Williams' baby," McConnell said. "It's all John Williams' music, and Vince selected and edited it into the game. I was sort of the sonic engineer of Williams' music. All I've really done for Vince is process the sound files so that they sound good."

Massaging 8-bit sound files to "sound good," however, is a complex and vital step in the creation of a memorable game score. The computer adage of "garbage in, garbage out" is never more true than

REBEL PROFILE — PETER MCCONNELL
Music Director (continued)

with digital music. With *Rebel II*, it was "gold in, gold out" because Lee was able to select *Rebel II*'s music from the three *Star Wars* movies and some outtakes that never appeared in the movies.

"Our goal was to make sure that the music sounded at least as good as *Rebel I*," said McConnell, 35, who has a degree in music from Harvard, "*Rebel I* had a certain punch to it because a lot of it was done in the analog domain and not the digital domain, and it was done with crude but very punchy equipment. This time we wanted a little better quality of sound without losing a significant amount of the 'umphh' that we got in *Rebel I*."

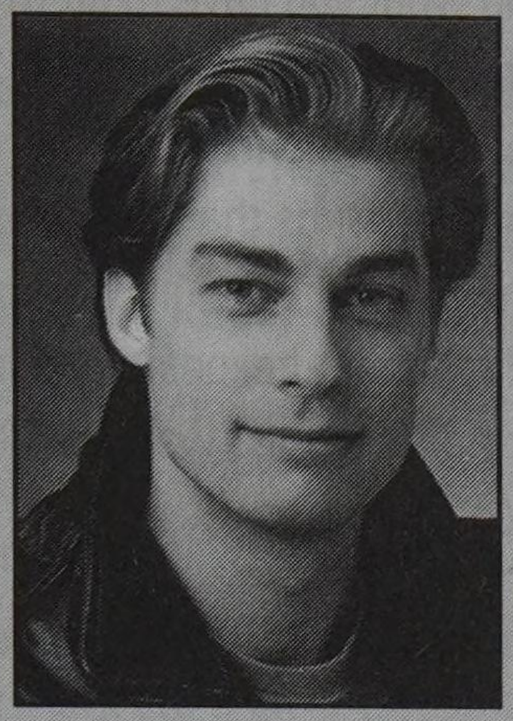
McConnell started by "down sampling," or reducing, high-resolution, files from a recent John Williams CD collection. To preserve as much of the richness of Williams' music as possible, McConnell made the first cuts in the music files while still listening to the full high-resolution recordings. "You get better results doing it that way," he said. "You can maintain some definition and detail that was lost in *Rebel I*. Fortunately, we had better tools this time around to reduce the music, so the end result was much better."

just wonderful because it turns out they have an intuitive grasp of hitting their marks, and physical acting is something they do well. There's a lot that, a lot of running around in these strange costumes that clatter like you've been covered with Tupperware as a punishment for some misdeed. It was a joy to work with them.

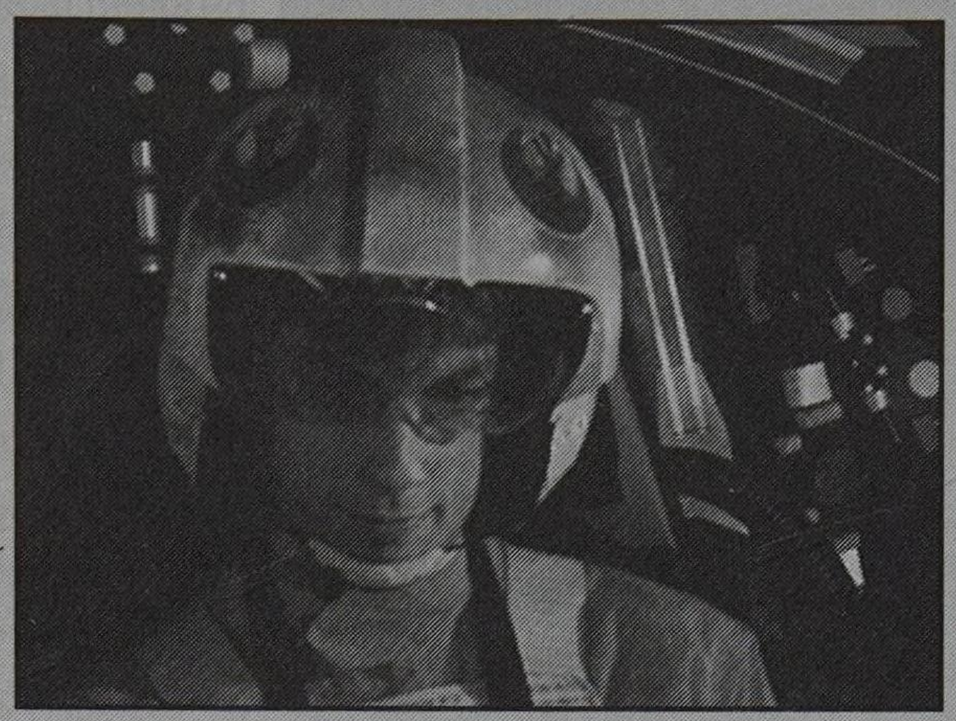
Was it difficult to get dramatic performances from the actors under the circumstances?

All right, I'll give you the most difficult shot that we did. It's actually more than one shot, several shots. Julie and Jamison are on speeder bikes zooming through a forest, which on a set means that they were really on little mountain bikes with grips steadying them and pushing them and pulling them. The camera is here, and I've got grips moving them back and forth as if the camera were tracking them, but not quite correctly. There's this slow movement going on, and we have this big wind machine buzzing away in their faces so it blows their hair and also gives them a feeling of movement so they can feel a little bit what it's like to be speeding along on these bikes. Meanwhile, we're also going through a forest, so we have dappled sunlight. So I've got this big thing on the primary light that's spinning and turning the light on and off. The physical circumstances are already very tight, they're leaning over these handlebars, and now

Rookie One and Ru on speeder bikes.



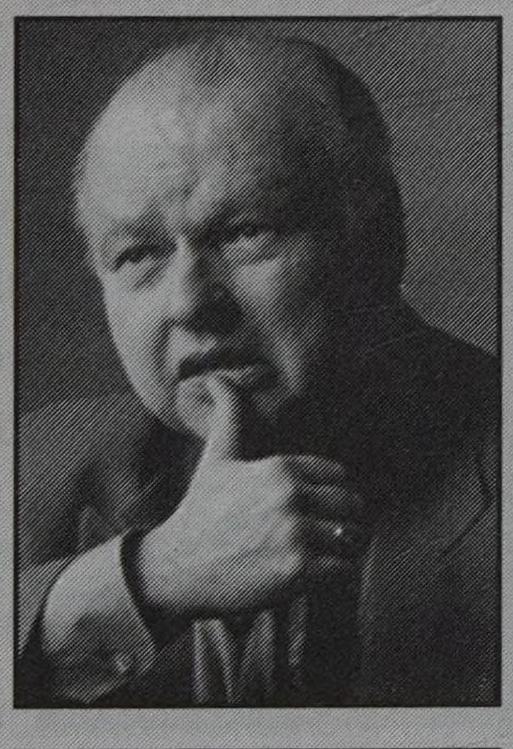
Jamison Jones



Rookie One

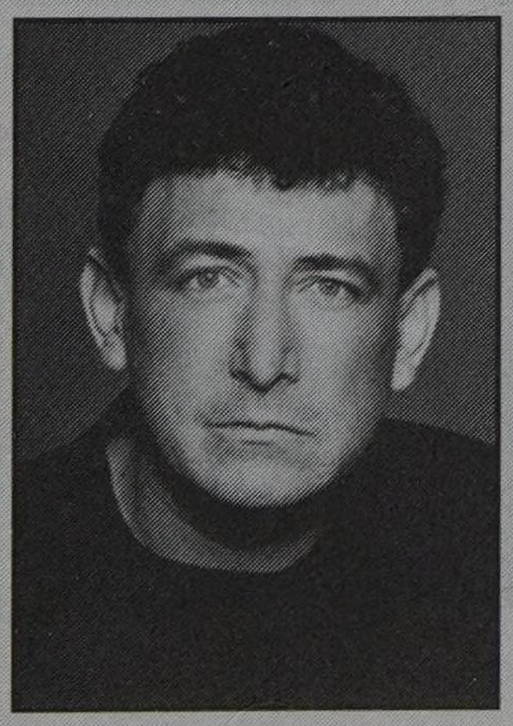
Julie Eccles

Ru Murleen

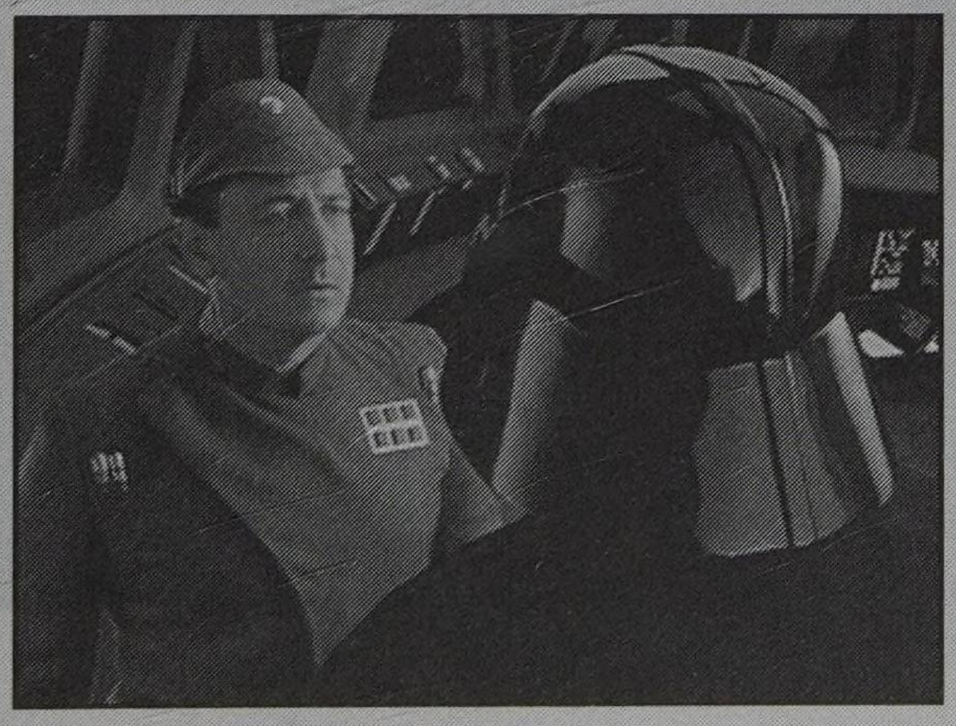


Roy Conrad

Captain Merrick



Gary Martinez



Admiral Sarn

REBEL PROFILE
PETER MCCONNELL
Music Director (continued)

But the process is time consuming. "You're really working with blinders on," McConnell said. "You can't really tell how it's going to sound until you reduce it to low resolution because that process changes the harmonic content of the music. Then you go back and compare it to the original music. And you just do that many times until you get something that sounds right. It's just a long turn-around time to compare lengths of music."

Speakers are another variable that must be considered. "The music needs to be tweaked so that it sounds good on the small speakers that most people play the game on," McConnell said. "Vince and I would listen to it on several pairs of comparison speakers. We use high-end speakers to listen to the high-resolution samples so we can hear everything in the sound and hear exactly what we're doing with the sound, and then we use the little guys for the 8-bit samples because that's really what the music has to project on."

After all the cutting and tweaking, the team ended up with low-resolution files that are much smaller in size than the high-resolution source material. The smaller the file, the faster the information can be retrieved from a CD-ROM, which is crucial if you want the music to play smoothly and continuously.

No matter how smoothly the small files play, they can still sound like a tinny low-resolution music sample, especially in what McConnell calls the "quiet passages." There's a cut scene before Chapter 10 in which Rookie One waits in a swamp for Ru Murleen to land her craft. The background music is soft and ambient — the kind of sequence where it's usually impossible to hide the dirty laundry of low-resolution samples.

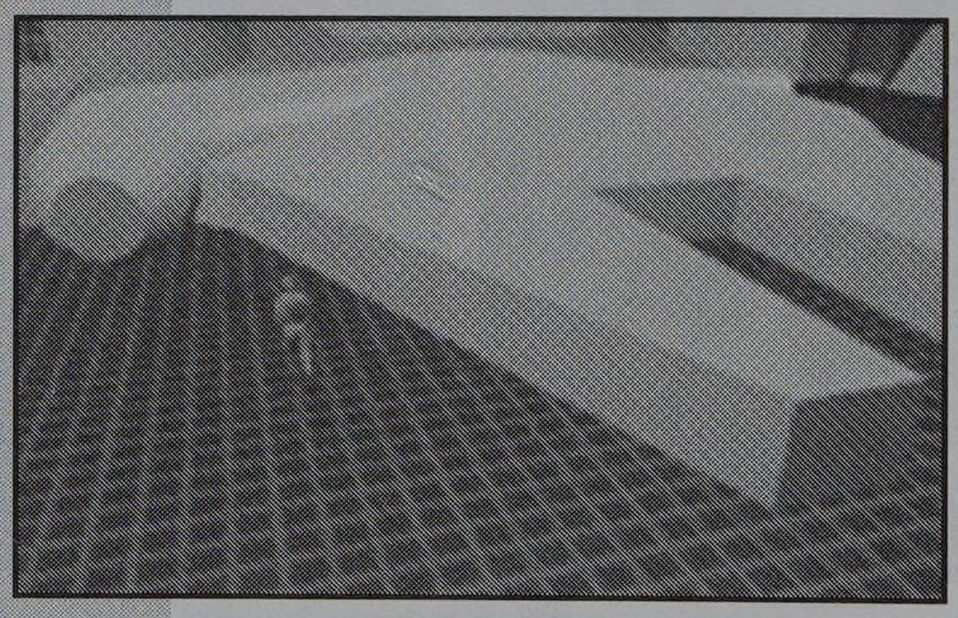
Julie has to deliver an expository paragraph of what the problem is and what you have to do to solve it. Essentially, she's talking to the player. She's talking to Jamison in the scene, so it's dramatic, but basically she outlines a series of steps that you have to go through to accomplish the next goal. It's an Olympic-sized achievement to get through that expository paragraph in a way that's convincing. And Julie was wonderful. That was the hardest scene, I guess.

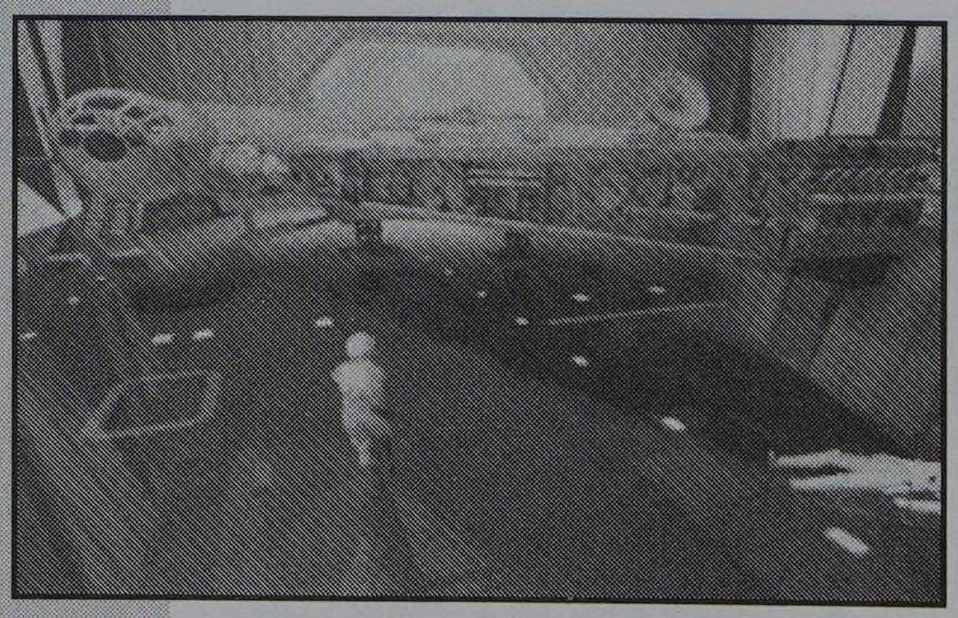
How many takes did you need to get it right?

It was the very last thing we did in first shooting session, and I guess it took about five takes. We don't do too many takes, and we don't too few. We just do it until it's done.

And all this was done in video?

Straight Betacam. We don't shoot on film. A lot of people do, but we don't. I don't propose that our method is best, but we certainly tested all alternatives very, carefully over a long period of time before we committed to





In order to get video into 3D animated backgrounds, rough 3D models (top) are used to approximate actors' movements. The final 3D background is added later.

what we would do. So we have a very good grip, technically, on how to do this stuff.

There aren't many people who understand the technology and all the different parts of this process. As more video is required in CD-ROM games, where will the know-how come from?

[Laughs.] Well, I certainly hope to be gainfully employed. But I think we'll learn. Directing is kind of a technical thing, programming is technical. I think people who can handle the precision of technical processes can learn to do this stuff. And there are a lot of directors who are pretty apt at it. I don't think it will be particularly difficult. I just think I am one of the early arrivals. But I think there will be others.

Now LucasArts is getting a few other people who have had some experience. (We've all had some experience now.) But it took a long time for the company in general to come to an awareness of why you have all these people on the set. Why do you have to have a costumer? Why do you have to have a continuity person? Why do you have these grips? Do you really need a sound person? Well, yeah, you need all those people. We did this in a minimalist way, but just trying to get people with software backgrounds to understand that they're not prepared to deal with the exigencies of production based on what they know about software — I'd say that was probably my biggest contribution.

Given the minimalist budget, how do you feel about the quality of the video?

It's wonderful. Within the context of the fact that everybody doesn't have computers that can do lossy compression, which comes back looking really, really good, we're always going to be faced with the limitation of software decompression technology. And dragging the bits off a little silver platter up onto the screen without the aid of some hardware devices is a pretty hard job. It

REBEL PROFILE

PETER MCCONNELL
Music Director (continued)

But Lee was not to be denied a well-defined and punchy score, even in the quiet passages.

"I can't say too much about what he did," McConnell said of Lee's low-resolution breakthrough. "But essentially he figured out a way to vary the resolution at different points in the files so that the quiet passages would actually play at a higher resolution. The result is amazing. It sounds in many cases closer to high-resolution sound than it does to low resolution. It's amazing you can do that with so little information."

But McConnell has come to expect the amazing from Lee. He ranks him among the top programmers in the industry, but he also thinks he's a good enough to be a professional music editor. "Of all the things that we know Vince can do," McConnell said, "he also has just a startling sense.of how to make music and sound effects — but especially music — work in a situation. It's rather amazing that a guy can do all of those things so well."

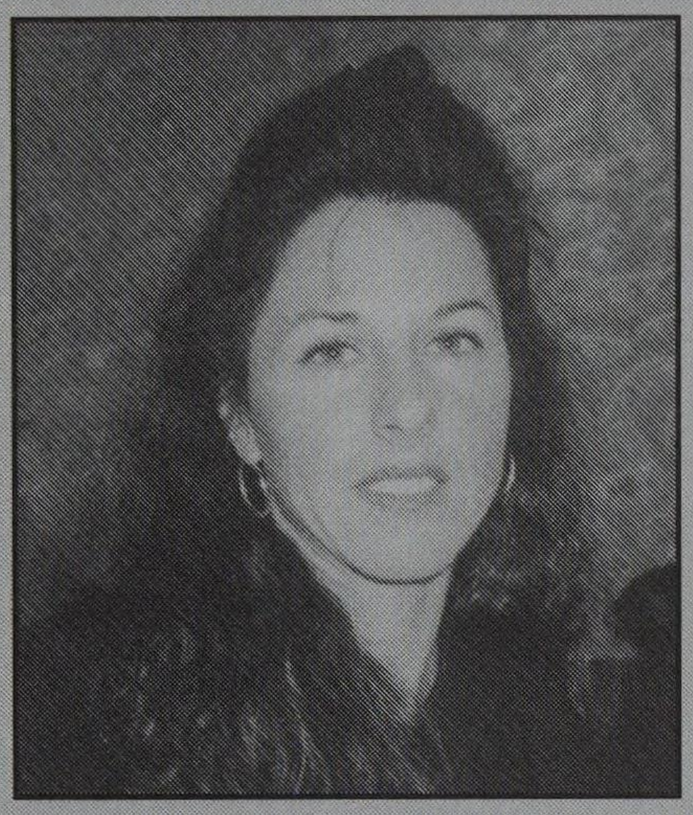
Like most of his sound and music cohorts at LucasArts, McConnell is a professional musician. He plays "anything with strings on it, and keyboards, but my specialty is electric violin." His describes his band, called Dervish, as "psychedelic rock 'n' roll. It's basically distorted violin a la Jimi Hendrix. That's what I'm doing when I'm not doing this."

"This" is five years of musical composition and sound engineering for LucasArts games. His most recent composition was the orchestral music for *Full Throttle*, which is integrated with the rock n' roll tunes of the band The Gone Jackals. He has written original themes for such games as *Sam and Max, Indiana Jones and the Fate of Atlantis, Day of the Tentacle,* and *TIE Fighter.* "I've pretty much composed something for every CD product that we've done since I've been here except *The Dig,*" he said.

REBEL PROFILE

TAMLYNN BARRA

Voice Director



Tamlynn Barra

The new emphasis on live-action video in computer games is almost the opposite of Hollywood's move from silent films to "talkies." Many popular silent film stars never worked again after sound appeared in Hollywood because their voices weren't good enough. With computer games, the voice technology came first and is now being augmented by video — thus there will be actors whose voices were great for animated computer games but whose faces aren't right for on-camera work in newer games.

The person at LucasArts who has orchestrated the transition from "talkies" to "watchies" in computer games is Tamlynn Barra, founder and manager of the company's voice department. She came to LucasArts in 1991 as the lead tester for a World War II flight simulator called *Secrets of the Luftwaffe* and went on to produce foreign language translations of games. In 1992, at the start of the "talkie" era, she jumped into voice production and direction. "At the time, the only game with voice was *Loom*," Barra say, "But the era of full talking was just coming into being." For the next several years, she produced and directed the voice talent for all of the company's games.

And then came *Rebel Assault II*. Barra had to cast acting talent as well as voice talent for about a dozen on-screen characters, including Rookie One, Ru Murleen, and Darth Vader. Was it a stretch? "Not really," she said. "I have a casting background in video as well as in audio production, so it was just a matter of applying my old casting skills, which haven't been used much here. It was certainly challenging to find actors who could bring to life new characters who had been created for *Rebel II*, and animated characters, like Ru Murleen, who had already been created for *Rebel I*."

Barra contacted talent agents, mostly in the San Francisco Bay Area, sending them a synopsis of the *Rebel II* storyline and profiles of the characters that were needed. The agents responded with a long list of names, which Barra whittled down to about 80 actors who were invited to come to LucasArts for an audition."

The auditions for the lead roles of Rookie One and Ru Murleen were directed by Hal Barwood and watched carefully by designer Vince Lee. "The actors read several scenes," Barra explained. "We

Voice Editors Khris Brown (front), Coya Elliot (middle), and Julian Kwasneski (back) make sure Darth sounds like Darth.

needs to be shipped over to hardware, and that will take a number of years because it will be a standards fight. And it's going to make things more expensive. Although it's not totally clear that that's necessary, I think it is. I think you eventually have to have this screen that can be a television set, it can be a computer — who cares what it is? — it can just handle these enormous graphic requirements. Given that slight reservation, I think it's wonderful. I think it's going to be a dazzling game.

The other thing is not that I think the game is particularly beautiful — which it is — but that it is very sophisticated in how it uses video and 3D modeling, and how the whole game is organized. It's a very sophisticated work.

What do you mean by organized?

Vince discovered in *Rebel I* how to interweave interactive play with presentation of video material. Most people don't have the faintest glimmer of how this should be done. I see game after game that is just idiotic. *Rebel Assault II* is just the opposite. It just knows, with intimate subtlety, how the game should flow from

REBEL BRIEFING

"Lossy" sounds like the name of the inventor of some technological breakthrough. But it's actually a term that describes the loss of image quality as you transfer and translate the visual information from one medium to another. In *Rebel II*, the video image starts in the Beta videotape format, gets transferred into a digital format that a computer can read, then it gets compressed in size so that it fits onto a CD-ROM and into Vince Lee's game engine. In each step, image quality is lost. In an ideal world, you would have a "loss-less" transfer process in which the original quality of the image that is videotaped is maintained all the way to your computer screen. That technology is on its way, but it will be some time before it arrives at your house.

REBEL PROFILE

TAMLYNN BARRA
Voice Director (continued)

had them do the scenes three or four times under Hal's direction so we could see how well they worked with Hal. A big part of the selection process was how Vince and Hal like the way the actors looked and acted for the part, and how Hal liked the way they responded to his direction — if there was a good vibe between him and the talent."

In a nutshell, the casting team was looking for leads that could be, in Barra's phrase, "fighter jocks" — two people who could look and sound like they belonged in a game that is essentially *Top Gun* in space. "Playing a fighter jock is not an easy thing to do," Barra said. "We have a lot of wonderful Shakespearean actors in the Bay Area but not many who are used to acting like fighter jocks in a space environment. We were looking for people who would be able to own the cockpit dialog and make it sound authentic, military. The actors had to have the imagination and ability to transport themselves into another time and place that isn't real for most people. And they had to be commanding and maverick, but still come off as authentic and sincere."

After the auditions, three or four actors stood out as the prime candidates to be Rookie One and Ru Murleen. But Jamison Jones and Julie Eccles were selected because of their "fighter jock" experience. "We knew Julie quite well because she is Jan Orrs' voice in *Dark Forces* and she's done quite a bit of voice work for us in the past. And, ironically, Jamison was doing another fighter jock role in something else just before he auditioned."

Was it difficult for them to make the transition to interactive video? "They're both really well-known theatrical actors," Barra said, "but neither of them had worked in multimedia before. But they took to it right away. They really had a great time. What all the actors had a good time with was seeing themselves in 3D scenery. With one monitor, they could see

REBEL PROFILE — TAMLYNN BARRA
Voice Director (continued)

themselves acting against a blue-screen background. With another, they could see a mock-up of the 3D animated environment. And then there was a monitor that showed the two composited together. It really kind of blew their minds, actually. They had never seen themselves in that type of scenery or set before."

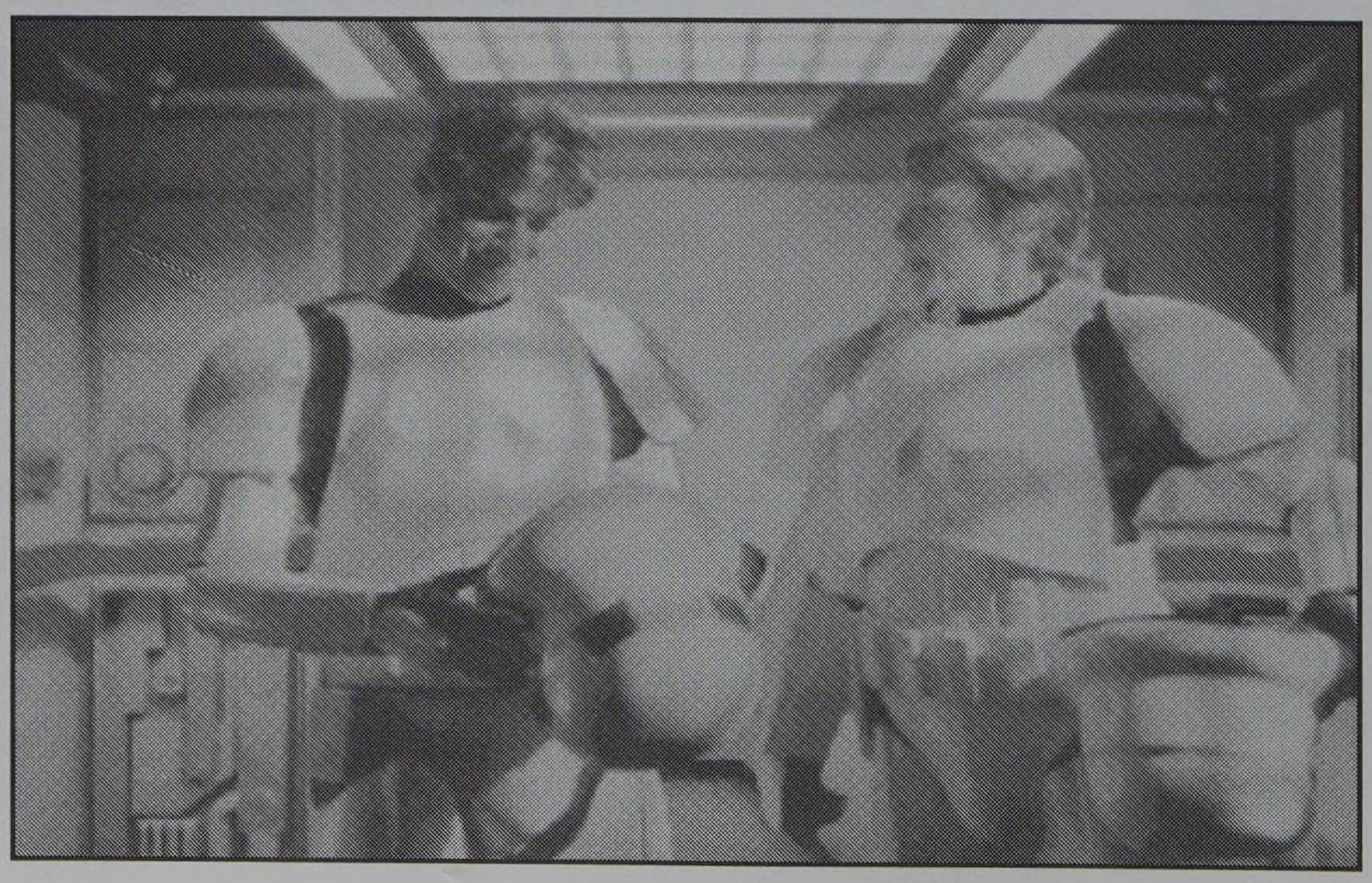
As the head of casting at LucasArts, Barra has seen two lifelong pursuits — technology and theater — come together, but it was hardly a carefully planned career choice. She received a degree in broadcast journalism from the University of Minnesota. She worked for many years with programmers and engineers developing high-end graphic software. That gave her a good technical background, and she had studied theatrical acting and direction since she was a child. She was honing her theatrical side when the Lucas opportunity appeared out of the blue.

"I had just finished as assistant director and interpreter on the Italian leg of a Broadway tour," said Barra, who speaks fluent Italian. "I returned to the

presentation into play and back into presentation again. Just the feel for the game's progress, how it feels to play it, is just really, really fine.

When I spoke with Vince about the creation of a game, he said that it's very important to have action and interactivity — the environment, he calls it — planned out before the story. Do you feel the same way?

I really don't quite agree with that, but I understand his approach, and it is a good approach. I think that actually there was an overall story. There was a premise. And the premise was that the Empire had been able to develop this invisibility device that they could place in small ships, and the story is to go and find out what they're doing and get an example of it so you can combat the problem. So that came first, even in Vince's mind. But then after that, the first thing you want to do is figure out what the player is going to get to do in the course of this. What are the 15 chapters, the 15 major things that we're going to do from beginning to end? And then you stitch the rest of it together, that's true. But you can't do any of the action until you know what the action can be, and that's a story concept. And I think that's a very effective way to deal with it. Because the most important thing is what a player is doing.



Rookie One pays attention during an exposition scene.

Dialog in games often sounds unrealistic. Did you have to tweak the dialog a lot to avoid that?

I may have changed a word or two here or there, but pretty rarely. I think it's fine. Vince has a pretty good sense of what that should be. Oddly enough, there's a phenomenon in gameplay that acts to his advantage. In a movie or in a television series, exposition is essentially anathema. And you try to disguise it and hide it and reduce it any way you possibly can. It's legendary how stars don't want to be involved in speaking exposition. They want their sidekick to do the exposition, and they get to look wise and say, "Uh-huh, sure, OK, let's go over the hill." What you're mostly interested in when you're watching a movie is the dramatic interchange. It's not so much a question of can James Bond, you know, flip the right switch and stop the bomb that Goldfinger has from going off. It's the scene where the laser is going up between his legs and he's bantering with Goldfinger. That's what's interesting about James Bond. His panache, his coolness under pressure. And you're watching that dramatically.

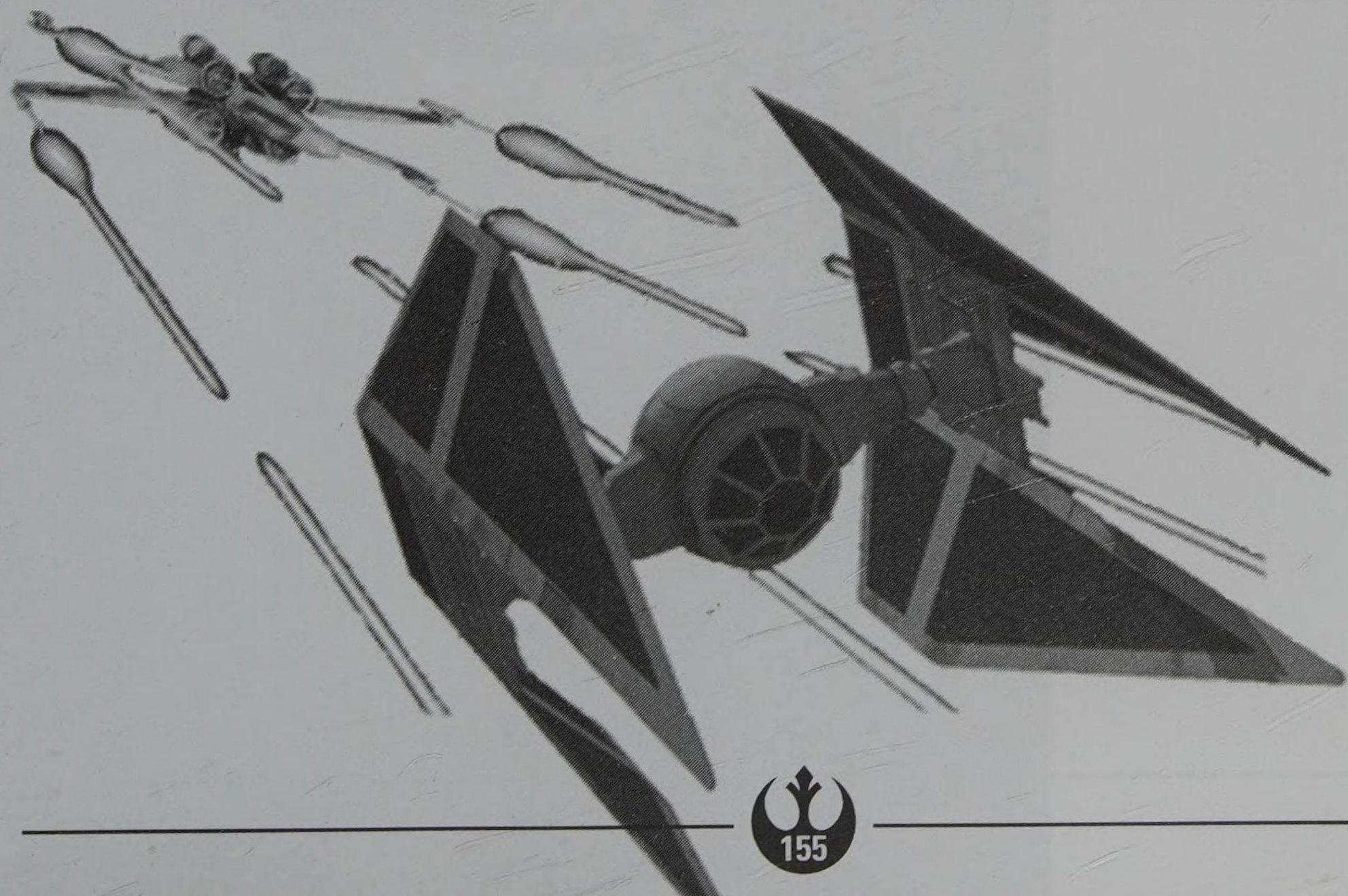
Personally, I don't think that drama works very well in an interactive experience. It's not that exposition is actually a completely positive and wonderful thing in a game and drama is completely worthless, it's just that the

REBEL PROFILE

TAMLYNN BARRA
Voice Director (continued)

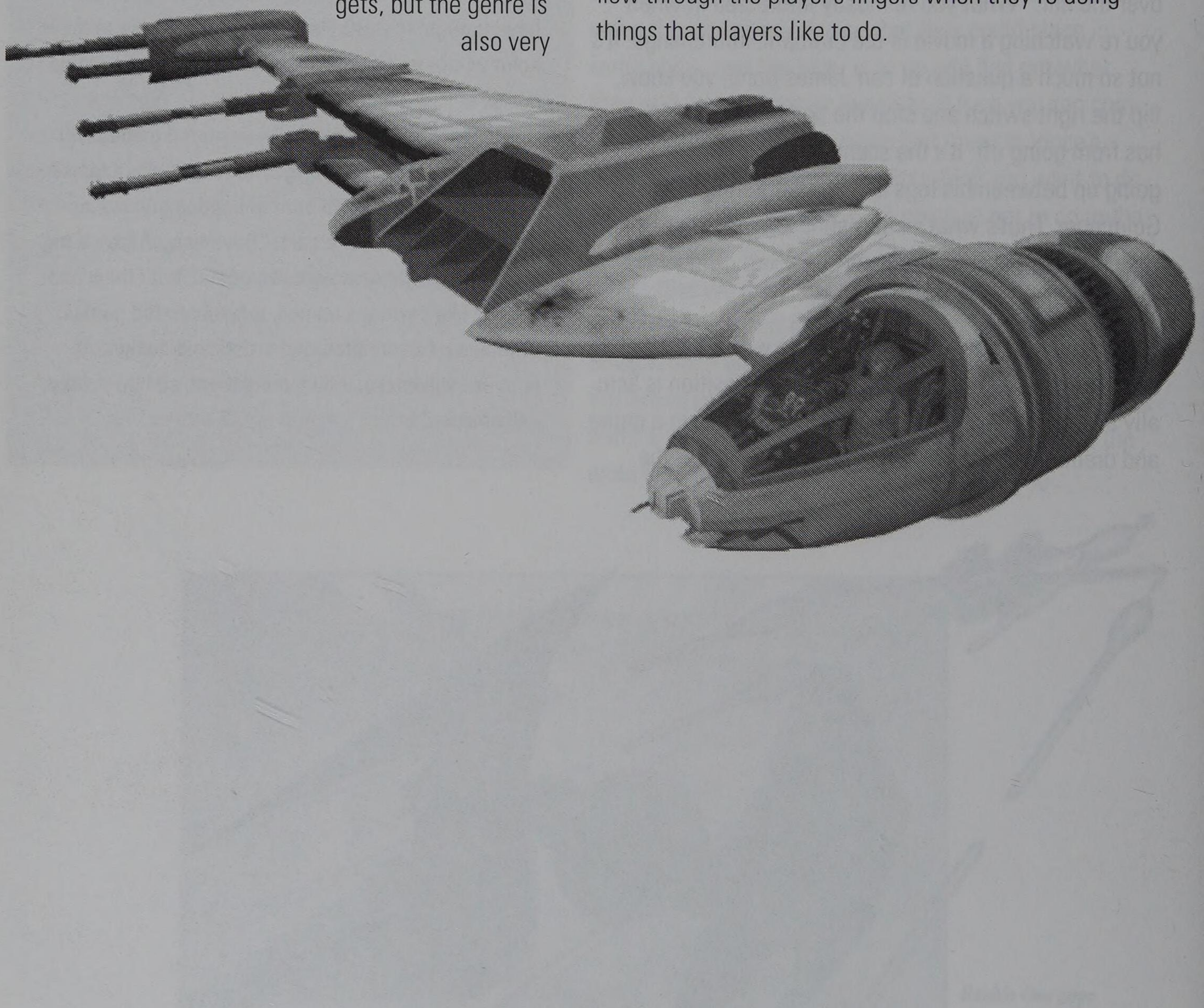
States, looking to establish myself in the Bay Area, when a friend who was working at Industrial Light and Magic offered me a part-time job managing computer support communications during the production of special effects for the movie *Terminator II*." While at ILM, she heard of an opening at LucasFilm Games — lead tester for *Secrets of the Luftwaffe* — and took it. "I figured it was another thing I could do while I was looking for a real job," she said. "But it turned into a career. Who would have thought that PC platforms would evolve to the point where traditional media and technology would merge?"

Does Barra think that fully-animated games with voice over will eventually go the way of silent films? "I think we'll always do both animation and live action video games," she said. "Obviously, there's a big fascination right now with live action, but I think people still like cartoony games, fully-animated games. We have a talented team of artists and designers who are still interested in doing them, so I think they will coexist."



value of the two shifts from a movie to a game. Drama is less interesting in a game because you're not in the business of watching something, you're in the business of doing something. So you're a little bit impatient in general with dramatic scenes. Especially if they're kind of idle, not directly involved with the immediate problems you face. You're interest just goes down. Meanwhile, you're interest in the exposition goes up because you need to get information about how you're going to do something. So you pay a lot more attention, just as the characters do in a movie.

There's an additional problem. There are the budgets, but the genre is also very young. The way drama has been presented in games historically has been very crude. We're kind of like where movies were 100 years ago. We haven't really quite invented the formula. For these reasons, we can't guarantee that drama is going to be successful anyway. I'm sure that over time people will find wonderful ways to make dramatic material work a lot better than we can do it now. But even though I've spent my life working in this area, I scratch my head about what that form is going to be. While we're working it out, the safe way to go, and the way that is the most exciting way to go, is to try to reduce it down to a minimum. Let the story flow through the player's fingers when they're doing things that players like to do.



CHAPTER 8

THE ADVENTURES OF COMPOSITING AND SMUSHING

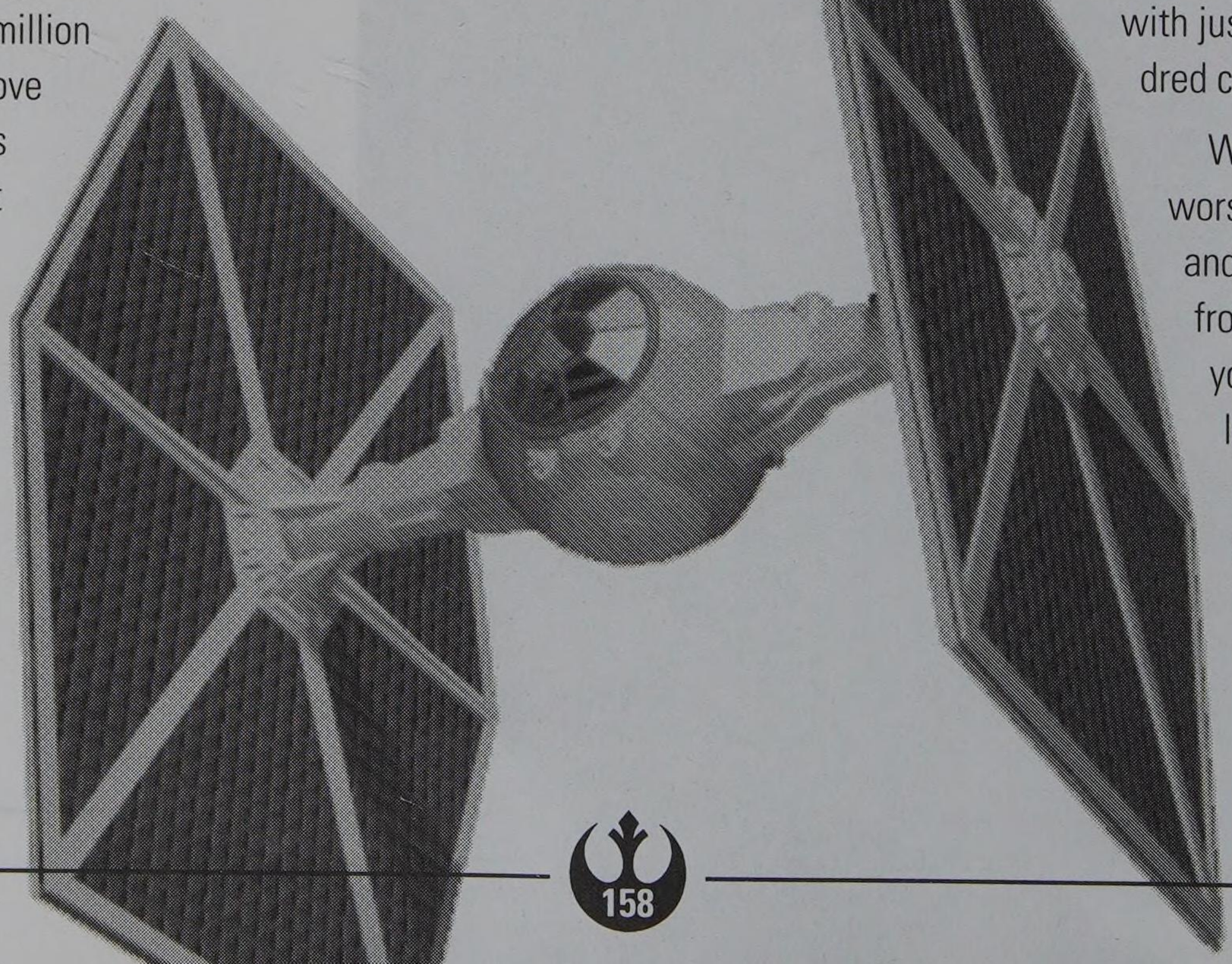
The Adventures of Compositing and SMUSHing

Your director can shoot beautiful video footage of fabulously costumed actors, and your 3D artists can draw cool ships and targets and backgrounds, then choreograph them in dazzling animated sequences. But no matter how exquisite your video and art, you're still a few galaxies away from a game that someone can actually play.

The first step is compositing. Someone has to take the two different mediums — video and computer-generated animation — and combine them so that they appear to be a seamless unit. Video technicians Mark Christiansen and Chris Weakley performed this sleight of hand for Rebel Assault II. *In the first section of this chapter,*

they explain the magic they employed to combine Hal Barwood's videotape, actual *Star Wars* footage, and 3D backgrounds.

Not so fast! There's one big problem, and it's called "lossy." When you're looking at television or at a movie, you're looking at "true color," or analog, images. They are composed of up to 16.7 million different colors, which is why they look so lifelike. But when you're running a game, you're staring at only 8-bit images, which feature a maximum of 256 colors. Do the math. If you take an image that has up to 16.7 million colors and remove all but 256 hues so that it can fit onto your home computer, you lose 16,699,744 colors. That's lossy — when you step down from one technology to the next, or from one medium to the next, you lose information and quality. It's a little like playing Beethoven's *Moonlight Sonata* with just three notes — you may recognize the melody, but it hardly stirs the soul. And until every home computer is 24-bit instead of 8-bit, computer game developers will face the seemingly impossible task of reducing beautiful video and computer art images with millions of colors into beautiful images with just several hundred colors.



Wait. It gets worse. After you chop and hack the images from 24-bit to 8-bit, you still have to lose more information. If computer games used straight 8-bit images, your computer could not pull them

off the CD fast enough to create a satisfactory illusion of speed and motion. Imagine playing Rebel Assault II if the action stopped every 15 seconds so the computer could run back to the disk and grab more pictures. Silent movies would be more riveting. To make the visuals stream uninterrupted onto the screen, the 8-bit images must be compressed into a smaller size. At LucasArts, the process is called SMUSHing, the name of Vince Lee's compression program. When an image is SMUSHed, it shrinks in size from up to 250K to 14K of information — another lossy step in the process that further reduces image quality.

Enter Aaron Muszalski and Doug Shannon, the art technicians on *Rebel Assault II*. The 3D artists and video technicians give these art techs composited movies (the game's playable sequences and the story-line "cut scenes" between them) in their beautiful 24-bit, true-color glory and ask them to squeeze and reduce and compact and crunch — without losing too much quality, of course. The second section of this chapter describes how Muszalski and Shannon SMUSHed more than 500 shots to make the game playable but still eye-catching.

COMPOSITING

Your job started before Hal Barwood shot the video footage for the cut scenes. Is that right?

Mark: We wanted to design the shoot so that it would minimize the problems in post production, and Hal is very good at that. We pulled apart Vince's script to make sure that we had the shots that we wanted. And we looked at *Star Wars* and *Top Gun* because those movies have terrific battle sequences with lots of intense close-ups, just like *Rebel Assault II*. We wanted to replicate the look and feel of those sequences in the game, especially in the cockpits. One thing that we noticed in the movies is that the cockpits move, so we decided, "We ought to make these things move." But we weren't sure we could do it. So we did a test. Hal came up with the rig the pilots sat on and he directed the flight motion that he wanted. Then it was up to me to

(1)

(2)

(3)

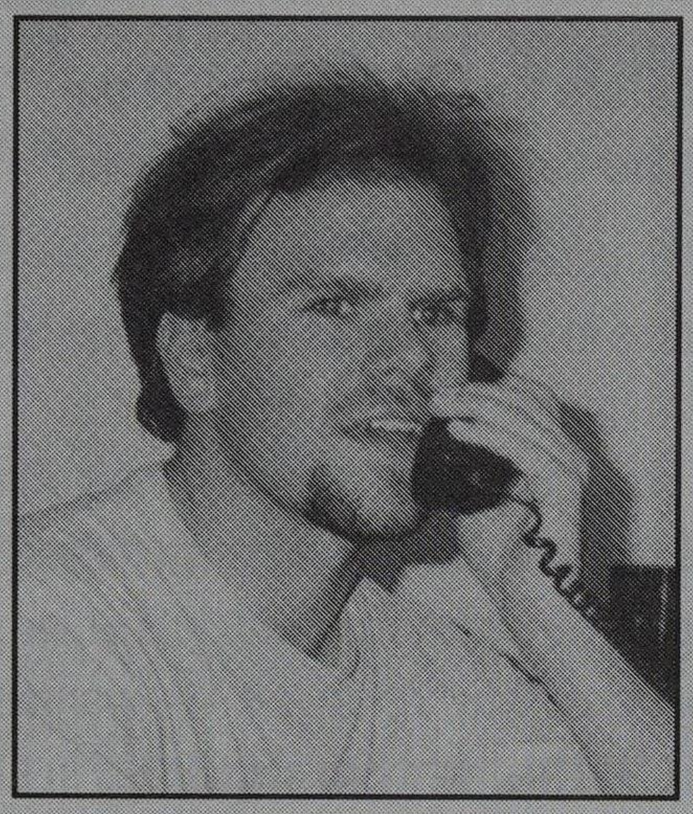
(4)

The process of combining video and animation. Christiansen started with the pilot against the blue screen (1). He added the background (2), but he noticed it's too light. He darkened the screen (3), then blurred the background to match the blurred pilot (4).

REBEL PROFILE

MARK CHRISTIANSEN
CHRIS WEAKLEY

Video Technicians



Mark Christiansen

Live-action video is a brave new world for computer games. If *Rebel Assault II* played at your local movie 10-plex or on your TV, you'd just shoot the actors, edit the footage, and that would be that. But *Rebel Assault II* plays on a computer that, at the current state of technology, is just a little better than your microwave oven for displaying video images. Therefore, if you want to have a computer game with decent-looking video images, you need people like Mark Christiansen and Chris Weakley.

Mark Christiansen is the head of the LucasArts video technology department. He's also been the only member of the video technology department for more than two years. But in the summer of 1995, three-quarters of the way through the development of *Rebel Assault II,* he hired Chris Weakley to assist him.

An actor and film director by training, Christiansen, 28, said he was "unwilling to go to New York or Los Angeles" in order to pursue either as a career. When he returned to the San Francisco Bay Area, he was hired as a production assistant at Industrial Light & Magic, the movie- and commercial-effects arm of Lucas Digital Ltd. But he wasn't well-suited for the job, he said. "I'm too absent-minded for

see if we could move the 3D background of the cockpit to match the movement of the pilots.

Obviously you figured out a way to do it.

Mark: I borrowed a basic technique from traditional animation called key framing. Let's say you're animating a character walking. The first movement of his walk goes from point A to point B, and those points are the key frames. You fill the frames between the points [a process that's called tweening] with one cycle of walking that's repeated — left foot to right foot and back again — so you don't have to draw them over and over. Then you set new points, or key frames, where you move the animation.

What I was doing with key framing in the cockpit sequences was a bit more sophisticated and required the computer to do it. With the pilots on the rig, we were simulating flight patterns of pitch, yaw, and forward and backward motion — which is entirely asymmetrical and chaotic. So what we would do is chart out where the pilot on the rig was reaching the furthest point of a movement and then stop — and that was a key frame. Then he would go down and to the right and stop again, and that was another key frame. And so on. By carefully moving frame by frame, we were able to plot each of these key frames then get the computer to simulate the path between them and therefore make the cockpit behind the pilot move like he was really sitting in it. If you tried to plot the movement for every frame, it would be like stop motion, very jerky. With the key frames, the computer can create a much smoother, dynamic motion.

What software were you using to pull that off?

Mark: Adobe After Effects. The developers told us were really demanding more from the key framing feature in the software more than it was supposed to be able to

do. They had designed their software for simple movements across the screen, maybe a wave pattern. But to use so many specific movements like we did was very unusual, but it worked. Now their new version has a feature called motion tracking that automates this process. But I actually think we will still be able to do a better job of tracking the motion by hand, frame by frame, than by doing it entirely with the computer. The computer does it through pure logic and isn't trying to feel the movement and the animation. So, for example, if you're having a pilot move his shoulders around, the computer would track the background movement to that and it would look very unnatural. By hand you get a better feel for the actual movement that you want to track.

Were some sequences harder than others to match?

Mark: The number of key frames you plot varies from shot to shot. Certain shots required a lot of key frames. For example, in Chapter 2, Rookie One crashes his B-wing, and it took hundreds of key frames to capture the finish of one motion and the start of the next. But the computer was able to smooth it out.

Rookie One prepares for a crash landing in Chapter 2.

What other tweaking did the video footage and 3D animation require as you combined them?

Mark: When you're putting together elements from two different worlds, it's usually clear where one starts and

REBEL PROFILE

MARK CHRISTIANSEN
CHRIS WEAKLEY

Video Technicians (continued)

PA work." The proximity to computers, however, inspired him to take a course on how to use Adobe Photoshop at San Francisco State University.

Photoshop training got Christiansen work at a start-up company, Luminaria, in San Francisco, that was developing multimedia games with Macromedia's Director software. He helped complete a game called *Wrath of the Gods,* an adventure game composed entirely of live-action video. "The work looks really crude to me now," he said, "but it was a great learning experience. They were one of the earliest companies to try it."

With a friend at LucasArts, Christiansen was invited to show the game to the company's art department, and they liked what they saw. This was the time of *Rebel Assault I,* when video and CD-ROM were just starting to become the "now" instead of "in the future." He was hired to investigate the possibility of combining a live-action character with 3D animated backgrounds for an adventure game. But the current state of the technology didn't match the dream. "We completed the tests," Christiansen said, "but the results were only somewhat satisfactory, not a knockout." The project was scotched.

Unlike many companies in the game business, employees at LucasArts are hired for their talent and creative possibilities, not just for specific projects. Christiansen was urged to continue his R&D video tests, which he did. But when an opportunity popped up to work in a computer exhibit on a summer-long Lollapalooza musical tour, his superiors not only gave their approval, they said he could have his job back when he returned.

MARK CHRISTIANSEN
CHRIS WEAKLEY

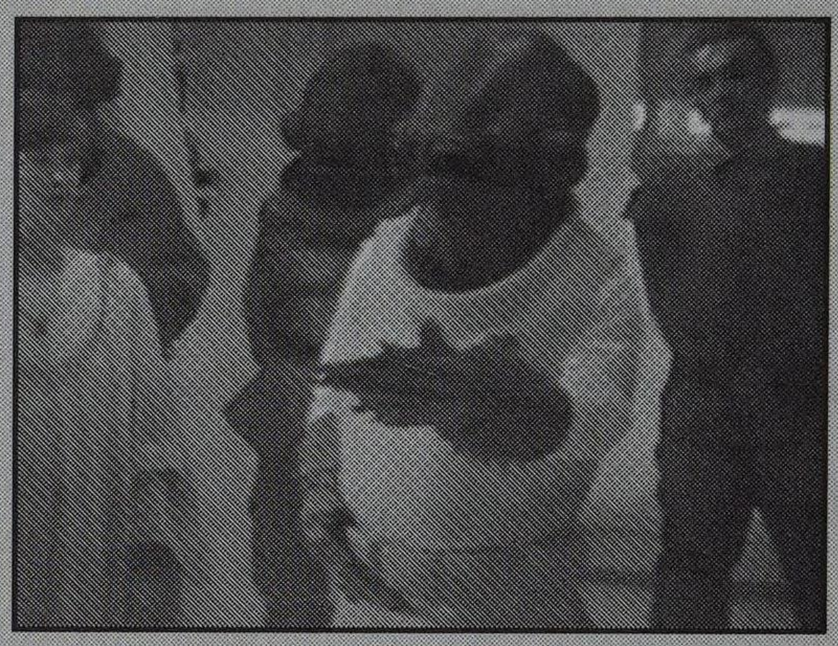
Video Technicians (continued)

Christiansen returned to LucasArts in the fall of 1994, just as *Rebel Assault II* was ramping into production. He worked for a short time on *Dark Forces* and *The Dig* before turning his full attention to the *Rebel* sequel. The technology had not changed that much since his earlier R&D tests, but players' expectations for video on CD-ROM had increased dramatically. "On top of that," Christiansen said, "this was *Star Wars*, so it had to look as much like *Star Wars* as possible, regardless of the technology."

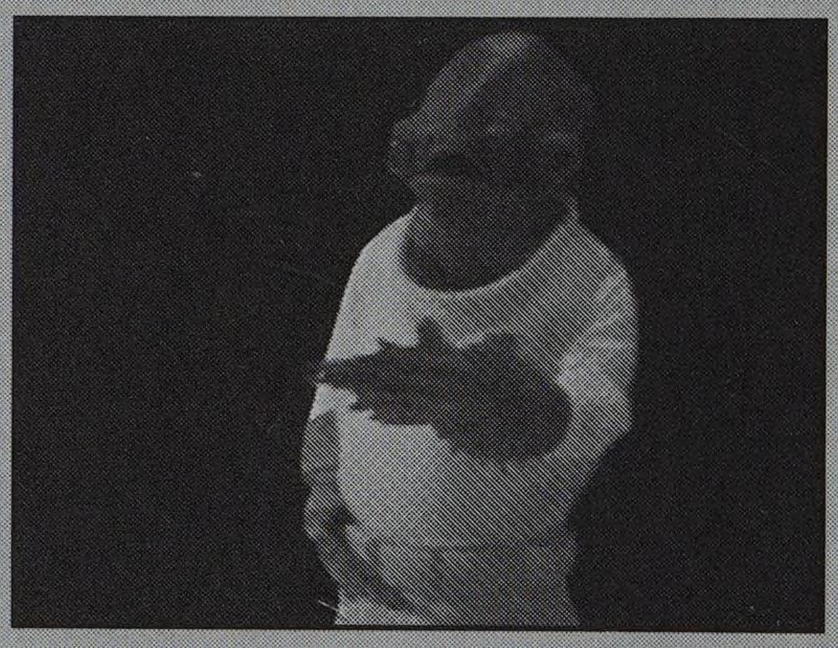
That meant Christiansen would be breaking new ground every step of the way, from the video taping of actors to compositing the video with computer backgrounds. But it was a challenge that brought him back full circle to his love of acting and directing. "We're at such an early stage with video in games," he said. "And there is a paucity of people in computers who know how to deal with actors. I feel I have one foot on the art side and one foot on the technical side, a pretty good place to be. It's sort of my mission to bring actors into this industry."

Unlike Christiansen, Chris Weakley has no front-of-the-camera aspirations. He's an experienced video after-effects technician who studied film and television production at Northwestern University. He worked as a production assistant at Calabash Productions, an animation studio in Chicago, then returned to his alma mater to design the school's brochures and catalogs. But not for long. "After 25 years of living in Chicago," he said, "I realized that I would never grow to love winter. So when a friend said he was moving to California, I said it sounded pretty good to me."

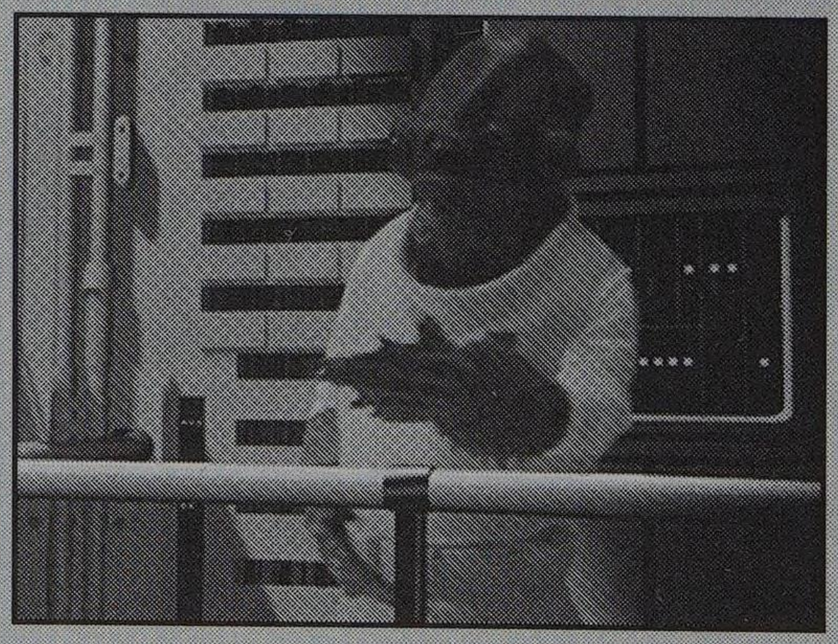
Weakley was hired as a freelance technical assistant at Industrial Light & Magic and started with after effects and video compositing for a dog food commercial. That was followed by a year-long stint at Colossal Pictures where he did similar work on TV commercials for Coca-Cola. While at Colossal, Weakley found out through the video grapevine that



***Weakley took footage from* Return of the Jedi...**



...isolated Ackbar...



***...and put him in* Rebel Assault II.**

warm up the background by adding some reds to it. It's a subtle art.

In another instance, Julie Eccles, who plays Ru Murleen, has wispy, blond hair, and sometimes the blue from the blue screen would come through her hair. So we yellowed her hair to avoid this strange color that would appear from time to time. This was all done in After Effects as well.

Another sort of color correction is called "dirtying" the image. Because the 3D art was created in a computer environment, it can be so immaculate that it looks incredibly stark against the video. At times we had to take a big screenful of clean background in Photoshop and add some reds, some warmth, some unevenness to make them more realistic, less pristine. What I've found is that in the real world, no matter how clean and new something looks, at closer inspection it still has some unevenness to it.

Ru Murleen

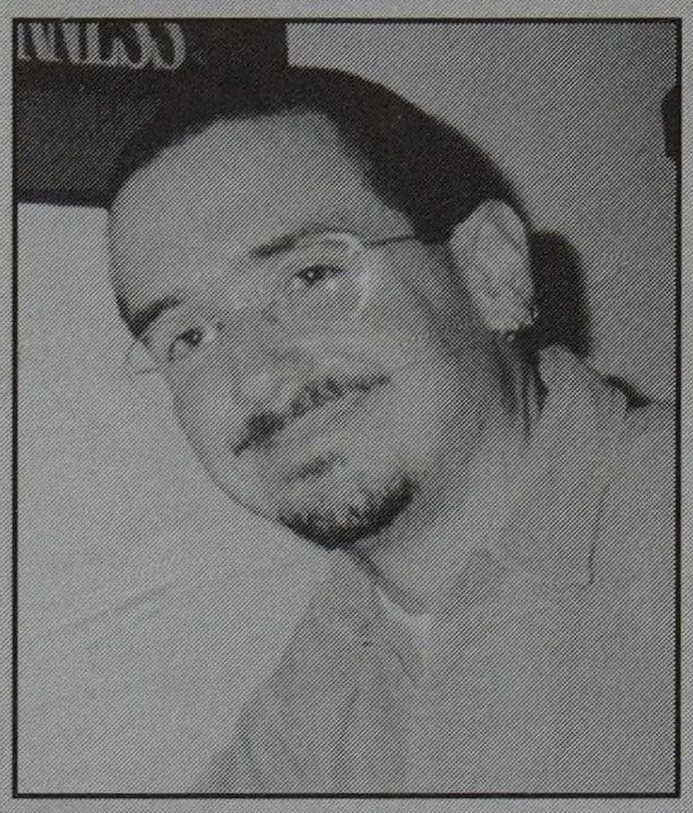
After you composited the images in 24-bit, full color, you would reduce them to 8-bit color. Were you satisfied with result?

Mark: A good way to think about this is to compare what you're used to seeing on TV or in movies to what is on a computer. One frame of television-quality video, full color, is about 700K of information. And one frame of what ends up going into this game is about 14K. So it's a major drop. The fact that we can get something

REBEL PROFILE

MARK CHRISTIANSEN
CHRIS WEAKLEY

Video Technicians



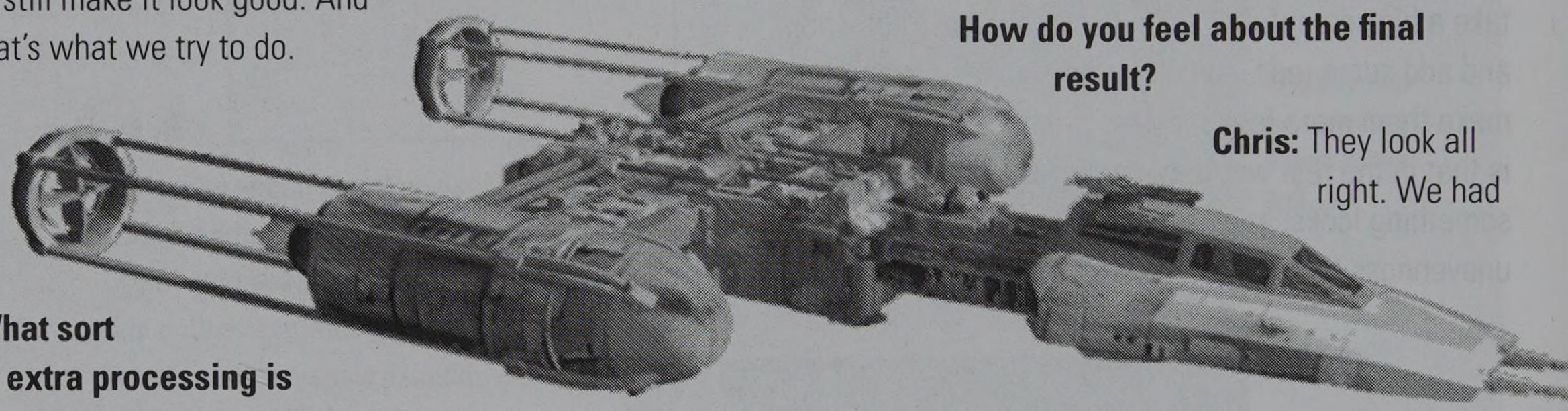
Chris Weakley

LucasArts was looking for someone who knew his way around Photoshop and video after effects. He jumped at the chance, interviewed with Mark Christiansen, and soon was sitting in his video technician's chair at the company — just in time for the Rebel Assault II "crunch." He didn't know much about games so his learning curve had to be fast.

"I came here when the game was more than halfway done," Weakley said, "and I started out as a jack-of-all-trades. Video shots, video processing, art teching. But that was good because it let me really learn how all this is put together. But after a few weeks, Mark handed the Ackbar shots off to me, and I had my hands full."

And video experts like Weakley and Christiansen will continue to have their hands full with CD-ROM games until computers makes a quantum leap in the video playback department. How soon will that be? Everybody and their brother is racing to be the first to have games that combine broadcast-quality video with instantaneous control and playback. But that race could be more like a marathon than a 100-yard dash.

that looks this good with that kind of frame rate just indicates that once that improves, we'll be in a lot better shape. With just 10 times or even five times the resolution we have now, you could do something that looks better than what's considered good, broadcast-quality video. There's a certain amount of compression that you can get away with that nobody notices. We're still developing for the lowest common denominator, which is somewhere between a single- and a double-speed CD-ROM drive on a 486. We're always working on a computer standard that's behind the state of the art coming out of stores. The art is to get away with it, to still make it look good. And that's what we try to do.



What sort of extra processing is necessary when you composite actual *Star Wars* footage with 3D animation?

Chris: We had the original footage of Admiral Ackbar from *Return of the Jedi.* He appears in two scenes, and there were about 13 or 14 shots that had to be processed. After we processed the shots, the new footage of Ackbar was re-used in several places, with different backgrounds or with additional characters like Rebels that he is speaking to.

First, I would look at the movie footage and basically "cookie cutter" him out, by drawing a matte line around him. I worked on a Mac with Adobe *After Effects.* The 3D artists would give me a new 3D background and I would animate it over time so that the only thing that appeared on this new background was Ackbar himself. Cutting him out of the film was very tricky. Ackbar is a dark character to start with and a lot of the shots tended to be kind of dark scenes on top of that. Often I had to look at these dark scenes and play them back a few times to figure out what was Ackbar and what was background. I remember one scene that I worked on for a couple of hours, very painstakingly putting this line around his head, until I realized that one section of his head was actually another character like him standing in the background. Suddenly there was this second pair of eyeballs.

After compositing the Ackbar footage, you still had to reduce it to 8-bit color, then compress it. How do you feel about the final result?

Chris: They look all right. We had a problem with the original footage because it was taken off of laser disc, and in the transfer I got, he tended to be blue and kind of washed out. So I had to do a lot of color correction, in After Effects as well, to bring him back to the original reddish-brown color that he was in the movie.

Because I had already done some art teching on the project already, I was able to process the Ackbar shots myself. I took them the whole way and I think they look all right. But you're bound to lose something in the translation. The original 24-bit images were about 1MB per frame. By the time they're ready for the game, they have to be 14K per frame. That's a lot of lost information. But I was able to do some little tricks to make them work.

LOSSY-ING YOUR MIND

What does an art tech do?

Aaron: In general, you're a way station between the artists and the programmers. What we do is work with the art, but do a lot of the more technical things with it that are either too complicated for most of the artists to be bothering with or not technical enough for the programmers to be dealing with. It's a job that's sort of in a neither-here-nor-there zone. Specifically what we do is different with each game, which is why I like it. On a SMUSH-oriented game like *Rebel Assault II*, the main task is to reduce and compress the 3D art and video so that it fits into the game format, but still looks good.

Describe the process.

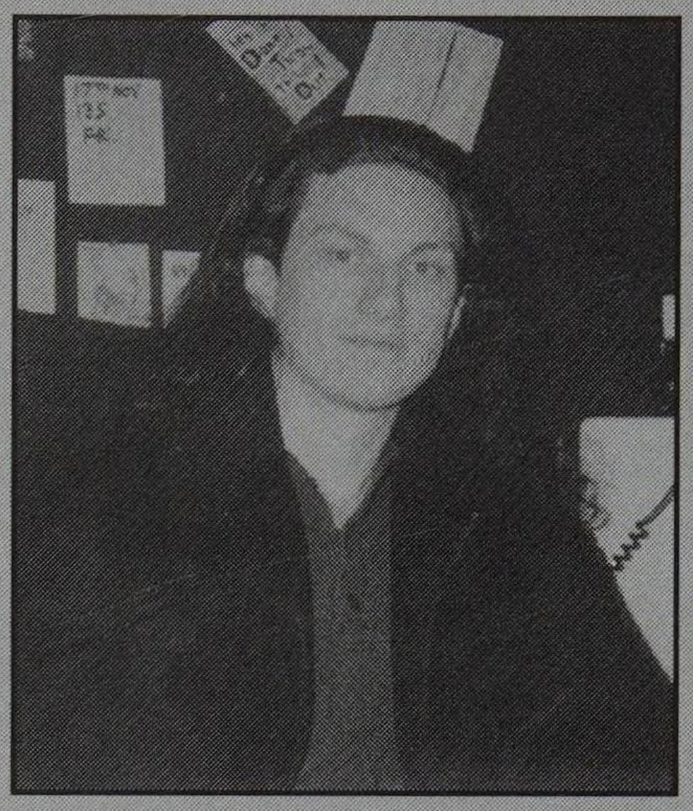
Aaron: All the shots we work with are 8-bit art, which means there are 256 available colors. But in most scenes, we use 32 of those colors to display the score and text and any other information that needs to show up on screen, so we reserve the first and the last 16 colors specifically for that purpose. And that leaves only 224 colors for the art. That would seem to be a simple thing for the artist: "If you're creating art for this game, don't use the first 16 and the last 16 colors," but it doesn't happen. Ninety percent of the art we get uses all the colors. That is something that the artist should be able to do with the art before it comes to us, remember to organize their palettes in this way, but sometimes they either forget or it's actually problematic on their side to do that. It's easier for them just to render it out using the full colors that 3D Studio gives them and let us take care of reducing the number of colors.

We perform many tasks in the process of getting the art from the artists to the programmer. The decision to use us is based on whether a task that we can do is an efficient use of either the 3D artist's time or the programmer's time.

REBEL PROFILE

AARON MUSZALSKI
DOUG SHANNON

Art Technicians



Aaron Muszalski

Art teching, as it's called at LucasArts, is a relatively new profession in the computer game business. That's why Aaron Muszalski, at the ripe old age of 25 and a five-year veteran of LucasArts,is one of the founding fathers.

Trained in both computer art and graphics, he started his career at LucasArts as an over-qualified tester, taking what he thought would be a "fun" summer job. He liked testing enough to keep at it for a year, but he was constantly itching to get into a more artistic role. "I was about to go insane," he recalls. "The first few times that I would get dissatisfied with testing, I would remember that I'm being paid to play games, how bad can that be? But the breaking point was when they started to give me foreign-language versions of games. Because you have played the original game for so many months you simply know what to do even though you can't read the screen. I was playing Spanish versions of *Monkey Island,* blindly clicking my way through things."

By that time, however, Muszalski had pestered the art department with enough offers for assistance that they gave him a job scanning images for an adventure game — and the profession of art teching was born at LucasArts. "The scanning was taking up

REBEL PROFILE

AARON MUSZALSKI
DOUG SHANNON

Art Technicians (continued)

too much of the lead artist's time," Muszalski said. "There wasn't even a position for it, but they knew that I was interested in anything to do with art. That was out at Skywalker Ranch, which was cool."

Since then, Muszalski has worked on *Rebel Assault, The Secret of Monkey Island, Dark Forces,* and *Rebel Assault II.* (Working on *Rebel Assault* was sort of a reunion — Vince Lee and Aaron went to high school together.) Art teching has grown into a more pivotal and defined role in the game development process. It's a key link between the artists who create the images and the programmers who weave them into the game. Muszalski was the first art tech at LucasArts, but now there are a dozen. "It's a good position for anyone who is a jack-of-all-trades," Muszalski said. "A good place for someone who is not the best artist in the world but has some computer experience, or for someone who has some technical experience but isn't necessarily a programmer. If any of us were better technically, we'd be programmers. And if we were any more determined artwise, we would be 3D artists. For people with aspirations in either of those areas, it's a good spot to get more experience so you can decide which of the two directions you might want to pursue."

His art-teching colleague on *Rebel Assault II* was Doug Shannon, 23, a self-taught freelance computer graphics wonk before he came to LucasArts for the last half of the Rebel project. "Basically, I'm here because of my knowledge of 8-bit graphics," he said. "Just about everything I talked with Aaron about in my interview was on the 8-bit side or lower. It's really hard to find people who know a lot about that."

Can you give me an example?

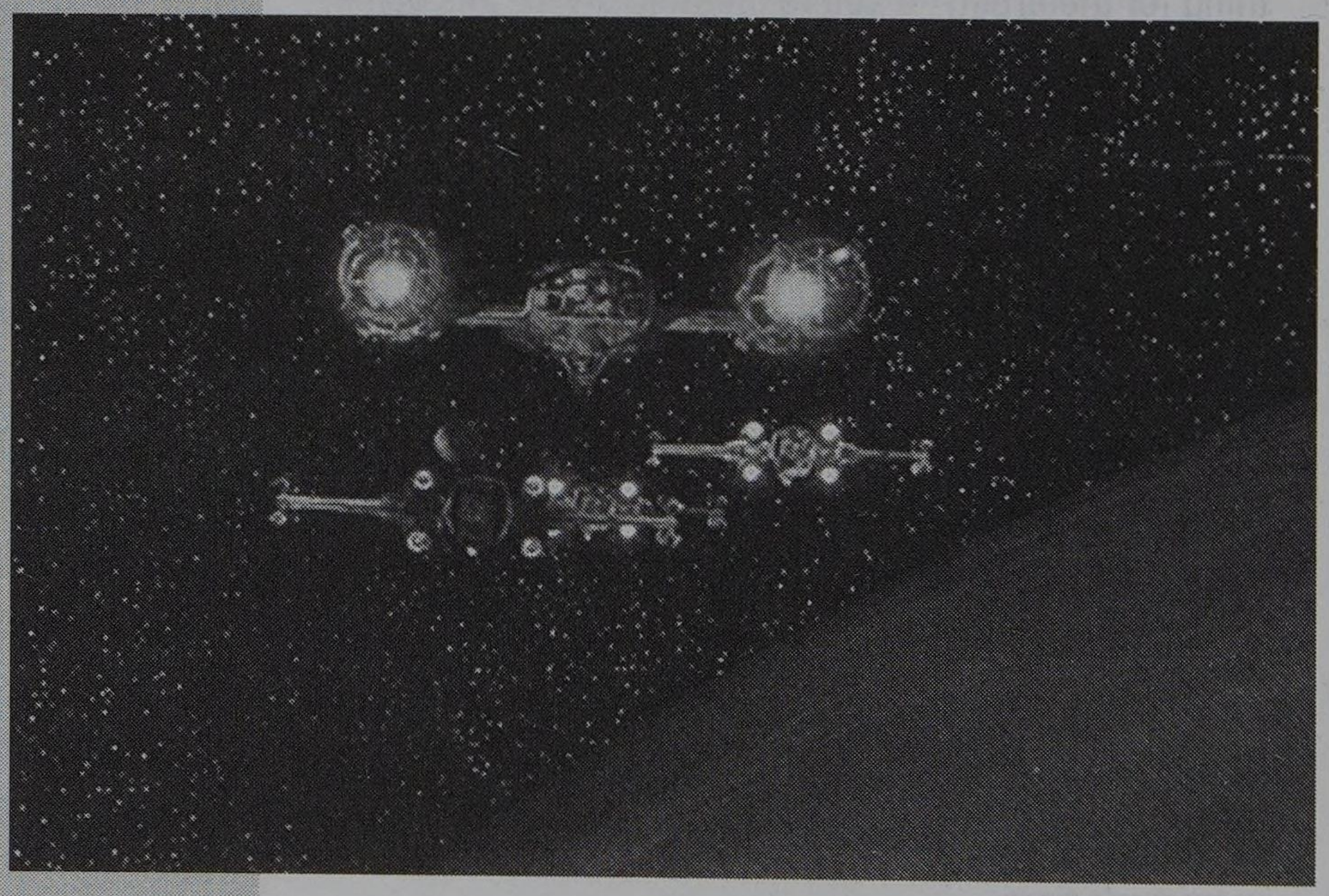
Aaron: One of the things that Vince had us do near the end of this game was add laser fire from enemy ships to most of the levels. That was taking just too much of his time, so he requested that we do it.

In *Rebel Assault I*, the 3D artists actually designed enemy laser fire into their animated environments. They were actual 3D objects flying toward the camera. But that was very, very time consuming to create in 3D. Before the second game was started, Vince decided to render in 2D some generic lasers that would come at you at various different angles.

You're flying through so fast you don't notice the lasers that much, so the quality is sufficient. After each level was finished, he'd put these lasers in by hand, on top of the level, but it was taking too much of his time, so we did it for him.

What were the major tasks for you in *Rebel Assault II*?

Aaron: One of the things that art techs do in almost every game is compression. Very often art techs are



given a lot of information and we have to reduce it to a smaller amount of information.

Due to the constraints of computer memory or the speed of the CD-ROM player — that is, how much and how fast you can take information off a disk continuously — you can't have an unlimited amount of information in your art. In Rebel Assault II we compress all the shots. What we hand to Vince are compressed files that he then arranges into the game.

More hours were spent compressing video in this game than compressing the 3D art. Unlike the 3D art that usually comes to us in an 8-bit, 256-color format, the video stuff comes to us as 24-bit QuickTime movies, which is true color — potentially 16.7 million colors.

We have to first reduce it down to an 8-bit palette, but again only use 224 of the 256 colors available. Now it's not easy to go from 16.7 million colors to 224 colors. So right there, you're throwing information away. And at that point, you have to choose what information is most important. What 224 colors out of all the colors that are being used in that image or in that animation are going to look best? The real art in this work is choosing which information to throw away and which information to emphasize.

For example, if the video shot, as most of them are, is a close-up of someone's face, people are obviously going to be more judgmental of the colors of the flesh tones in the face area than in the background grays of the ship behind them. So you can skimp on the grays in the background in order to allow more of the gradients in the face to show. That's a decision that an art technician will have the time to make that someone else in the process might not be able to get to.

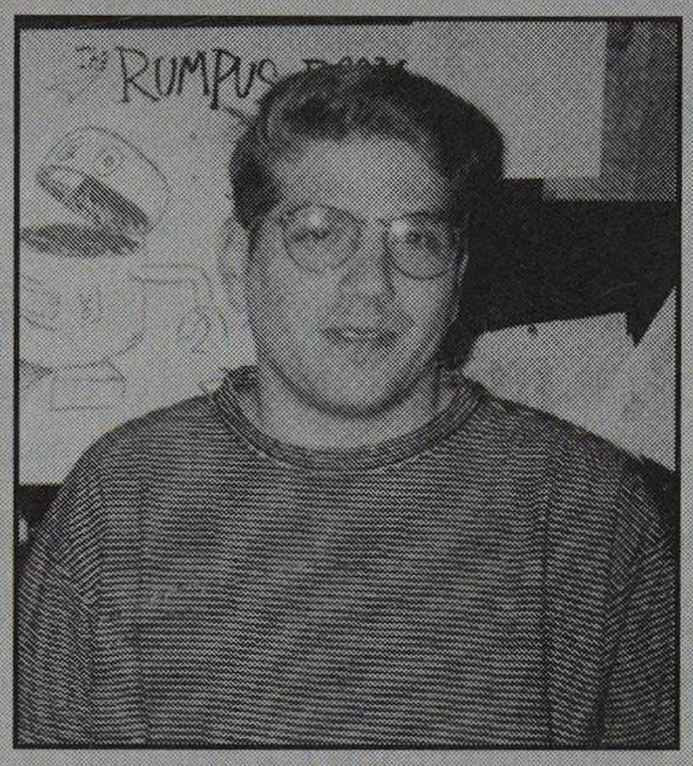
Can you describe some specific examples of different shots or sequences that you processed?

Aaron: There are two basic kinds of shots that we worked on. Doug can tell you more about the video

REBEL PROFILE

AARON MUSZALSKI
DOUG SHANNON

Art Technicians (continued)

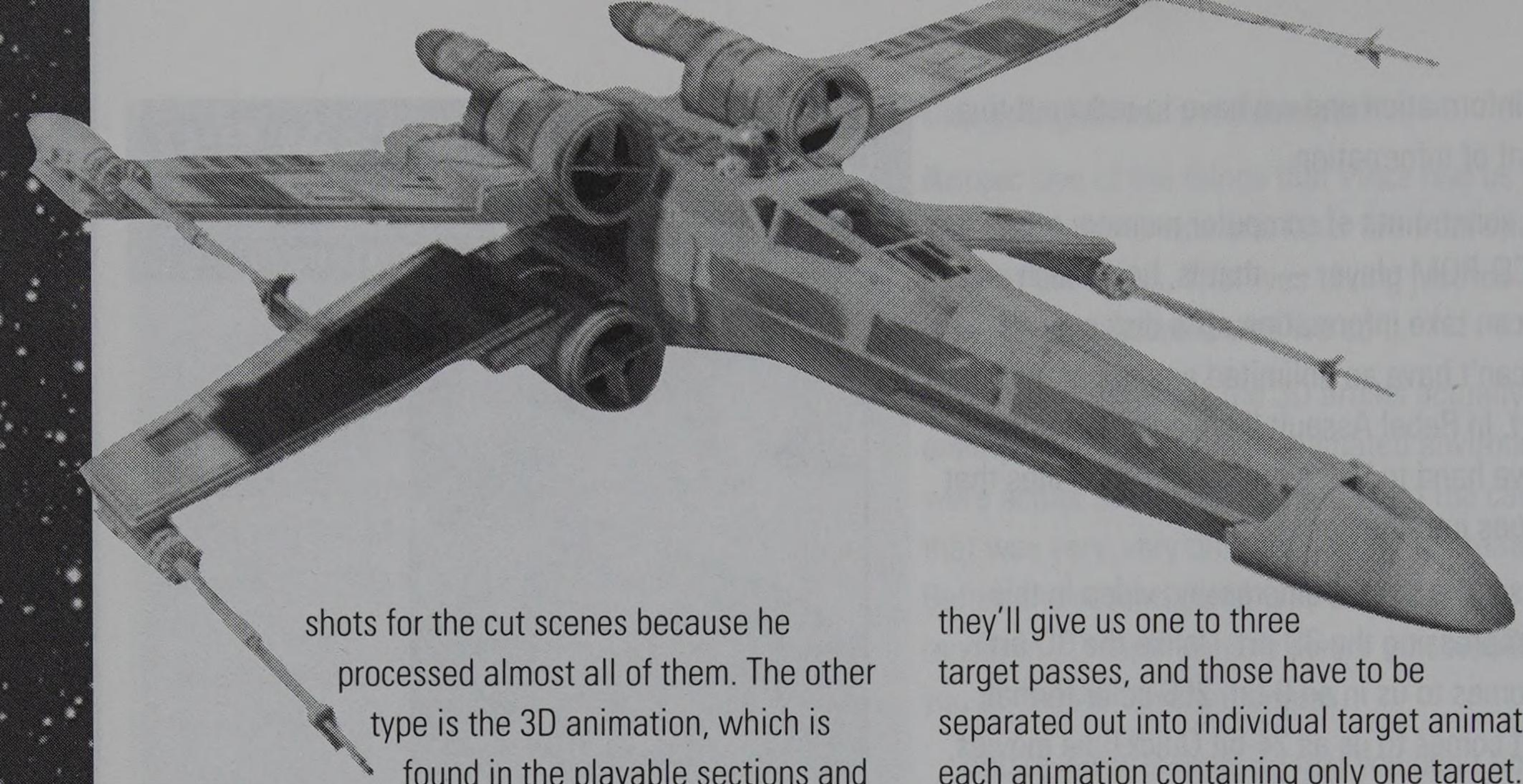


Doug Shannon

Shannon bought his first computer, an Amiga 500, in 1988 for the express purpose of learning how to create video game graphics. Because of its wide range of color and sound, the Amiga was a fertile platform in the '80s for would-be gamers and many people on the Rebel Assault II development team, including Shannon and Muszalski, Vince Lee, and 3D Artist Dan Colon and Craig Rundels. "I started out on the Amiga," Shannon said, "and learned a lot about low-color stuff on it."

Shannon hunted for any work that would bring him experience in computer video or graphics or sound. He did some game work for Crystal Dynamics, was on the Deluxe Paint development team at Electronic Arts, wrote for *Video Toaster* magazine, and was doing interface design for Windows 95 products when he decided he definitely wanted to be making video games. "I quit my job," he said. "And then I found out that LucasArts was looking for people who were experienced in dealing with low color. There aren't many." Because the only medium that continues to use 8-bit color these days is games, low-color specialists are increasingly rare these days.

Rare but vital in these early days of computer graphics. Until computers become more graphics friendly, art techs such as Muszalski and Shannon must continue to be more technician than artist.



shots for the cut scenes because he processed almost all of them. The other type is the 3D animation, which is found in the playable sections and in the cut scenes.

The playable sections are typically more grunt work, requiring less creativity than the other two. While they do offer some opportunities for creative problem solving, there's more of that with the video. The major problem is that 3D animation files are very large and slow to work with. The 3D artists give us a background and the targets, separately. If you shoot a target like a TIE fighter or a target drone or an asteroid, it needs to be blown up — and then you don't see it anymore from that point on. So they'll give us a background with everything that you can't destroy, the static parts of the animation. And then they'll give us one to three animations that contain all the targets — 50 to a couple of hundred target objects contained in several animations. The reason for that is it would take them too long to set up and render 200 separate individual animations. And if they only rendered one animation, it's very likely that the targets would overlap one another.

The reason they can't overlap one another is because if you shoot one, it would disappear, but you would still see a hole in the one behind it where the first one used to be. So no two targets that you could possibly shoot can ever overlap. To avoid overlapping, they'll give us one to three target passes, and those have to be separated out into individual target animations with each animation containing only one target. And that's pretty brainless. You have to keep any eye on it, watch when it disappears, and then paint out everything but that one target until it goes offscreen. Then once that is done, everything has to be compressed.

The 3D animation in the cut scenes gives us a bit more flexibility. When a 3D cut scene comes in, you have to choose a palette for it. The scene will come in using 256 colors usually, but it has to be reduced to 224 colors. That's not too big of a job. It's definitely better than the video cut scenes. We're much more cavalier making the jump from 256 colors to 224 than from true color in the 24-bit video shots. We can do that pretty fast.

Because video is more difficult to reduce and compress, what's the process for handling it?

Aaron: We definitely scrutinize it much more than the 3D animation. We'll check back and forth between the original image and the reduced image.

Doug: We had to process about a dozen shots for each level. Basically the video comes to me from Mark Christiansen and Chris Weakley in 24-bit, uncompressed QuickTime files that usually run from 100 to 400 frames. Every once in a while we'll get one that is

800 to 1,000 frames. They come to me in 320 x 200 resolution, 15 frames per second — that's half television, which is 30 frames per second — so I don't have to change the the frames per second or the aspect ratio or anything like that.

I start by examining each shot. I look at all the frames and determine if there are colors that are introduced later on in the animation that aren't there in the beginning. For example, even though it's not video, you might have a TIE fighter that explodes later in the sequence. The exploding colors aren't there in the first frame; they're introduced later on. Many companies have a program that just looks at every frame of the animation and then builds a palette around all of them. I don't do that because it takes too long and I don't think the results are worth it. I do it by hand. I go through and examine the QuickTime sequence, and from that I choose key elements from which the colors are extracted. Then I use DeBabelizer to pick a base palette — kind of a rough draft. And then I go back and say that the skin tones need more color or this explosion looks weak, add more color to that, and I basically crop the element down so that all I'll have on screen is the explosion.

Then I tell DeBabelizer to give me the best 8 colors or 16 colors it can match for this explosion, and I paste it into my palette by hand. So it's a lot better. You'd be amazed at how goofy of a palette these automated palette programs will pick if you don't tweak them like that. All the math is proprietary to all these programs and they won't tell us exactly how it's being calculated, so you can get dark purples and blues in a gray background and not have any idea why.

"The face is the most important thing."

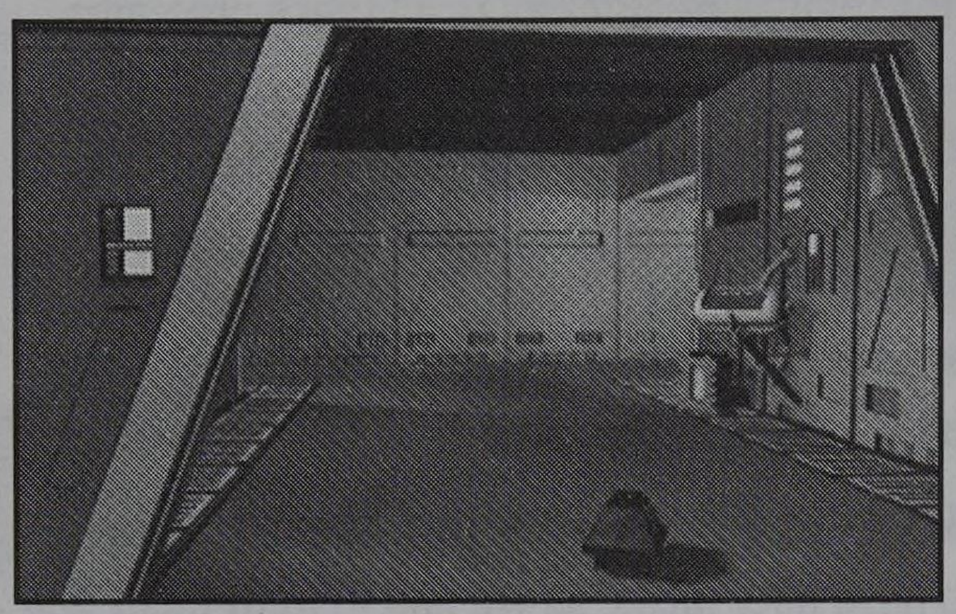
Did close-ups of faces give you particular problems?

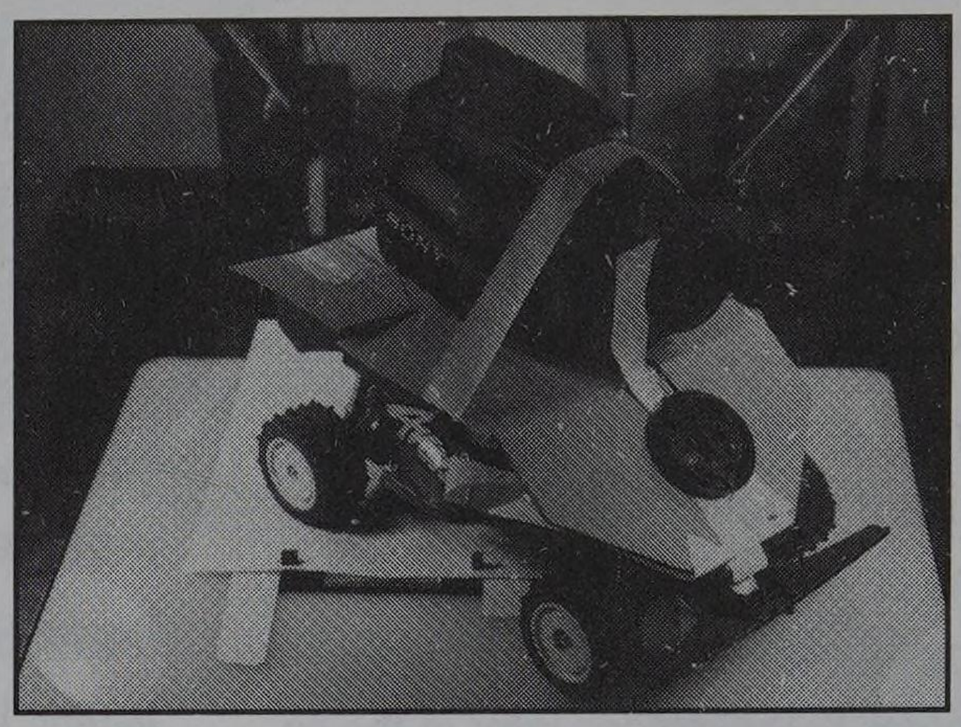
Doug: Skin tones are very important. We didn't want people to have dirty faces, so we had to treat them carefully. A face is only on one-tenth of the screen so when DeBabelizer picks the palette, it obviously does not say, "Oh, the face is the most important thing." So I have to go in and add color to each of the faces.

In Photoshop, I take the four most unique frames from the QuickTime footage and I paste them into one large document in Photoshop. Then I run that document through DeBabelizer, using some of the tools there to hand-pick the palette. If you just tell it to make an 8-bit palette, it will make a crummy one, but if you give it your own hand-made palette, it will map those colors perfectly. Sometimes you have to pick more than four frames to get the right palette. If you run the processed sequence through and then spot a glare on the guy's nose, you have to go all the way back and add that element into the shot and make sure that those colors get remapped.

What was the toughest video sequence to process?

The mousebot shot at the beginning of the game because it's so long. There are over 1,000 frames. It would take all night to render after I made some changes. And you just don't know. You go through so many elements — robots, stormtroopers, dark areas, light areas — I had to render that one three or four





The test for the mousebot sequence was filmed with this home-made camera car.

times to get it right. I chose nine of the most unique frames that I could find and then animated a palette for it. Then I'd render out all 1,500 frames overnight. I'd come back and notice areas that didn't have enough color in them, then go back and modify that palette — and I had to modify that palette three or four times.

How long does it take to process a shot?

I got to be pretty fast at it. Most shots took about half an hour. But it probably took me about two hours to get the mousebot shot ready. That doesn't include rendering time, after you make the color changes, which takes much longer.

Are you happy with the results of the video footage?

I'm happy. But it's always kind of frustrating to stare at artwork that's 24-bit for two hours only to have your final product to end up in 8-bit. The mousebot shot is so long that it goes through almost every color in the palette, every color in the rainbow, so that shot didn't work out as well as others.

But generally with most of the shots, we get really good skin tones and a lot of good colors in the computer panels, so most of the time I'm pretty happy. If I don't see any horrendous banding, I'm pretty happy.

And after you reduce and correct the color, you still have to compress it further.

We call it SMUSHing, and it takes every frame down to about 14K so that it can be pulled more quickly from the CD. One video sequence, for example, that might be 28 megs in 24-bit color is smushed all the way down to 4 megs in 8-bit color. It gets small very quickly — and you lose some more information. But SMUSH minimizes that loss. It works better on some shots than others. The rule of thumb is that the less movement you have onscreen, the less changes you have onscreen, the better the image looks after it has been SMUSHed. But I think we still got a lot of good shots with a lot of good motion in them, and they still compressed really well. Someday we hope everyone will have 24-bit machines — of course, then it will take 100 CDs to play a game.

What are the tools of the art teching trade?

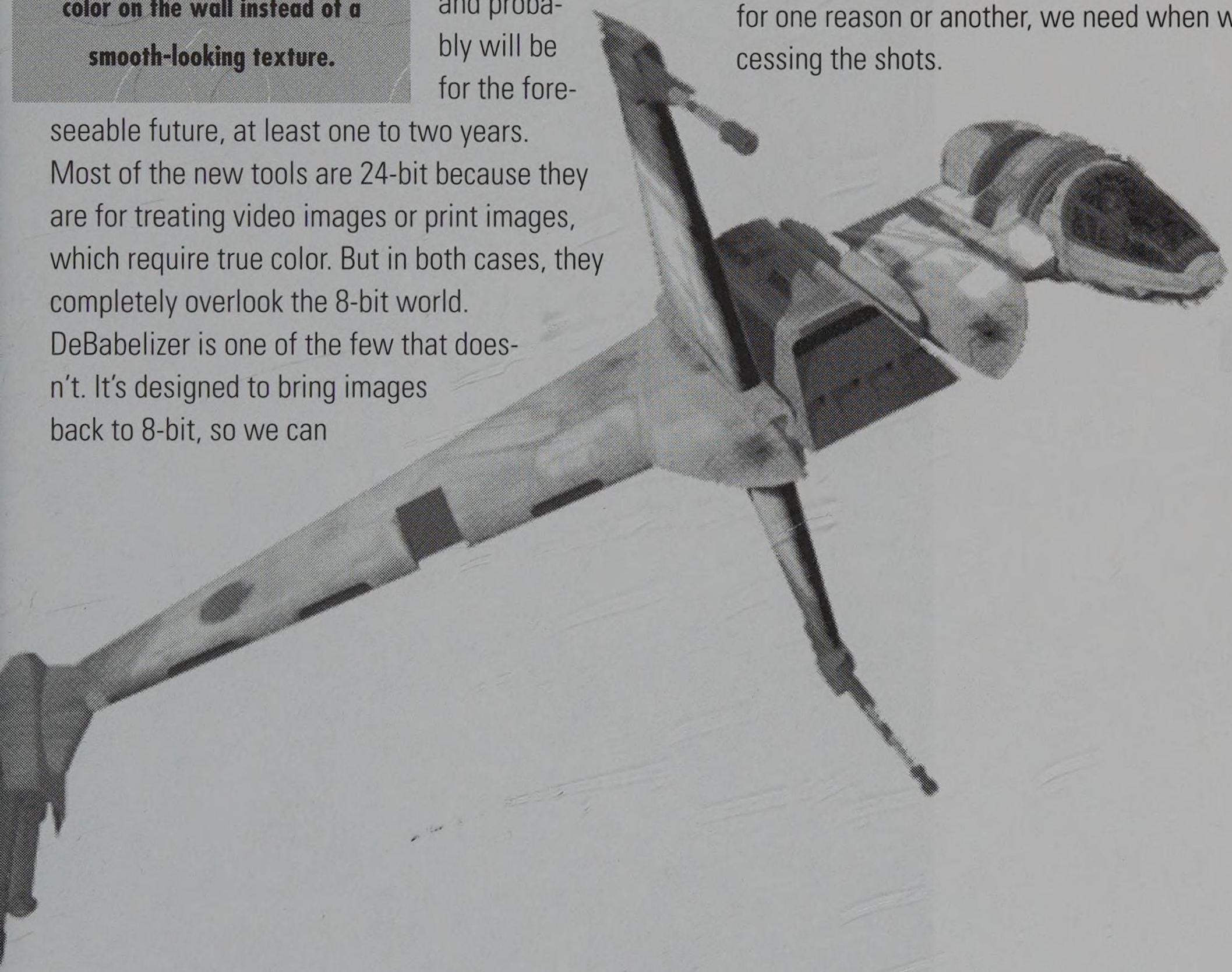
Aaron: The compression is done on the PC. Most of the processing is done on the Mac. We use any and every tool we can get our hands on, like DeBabelizer and Photoshop on the Mac side. On the PC side, we use

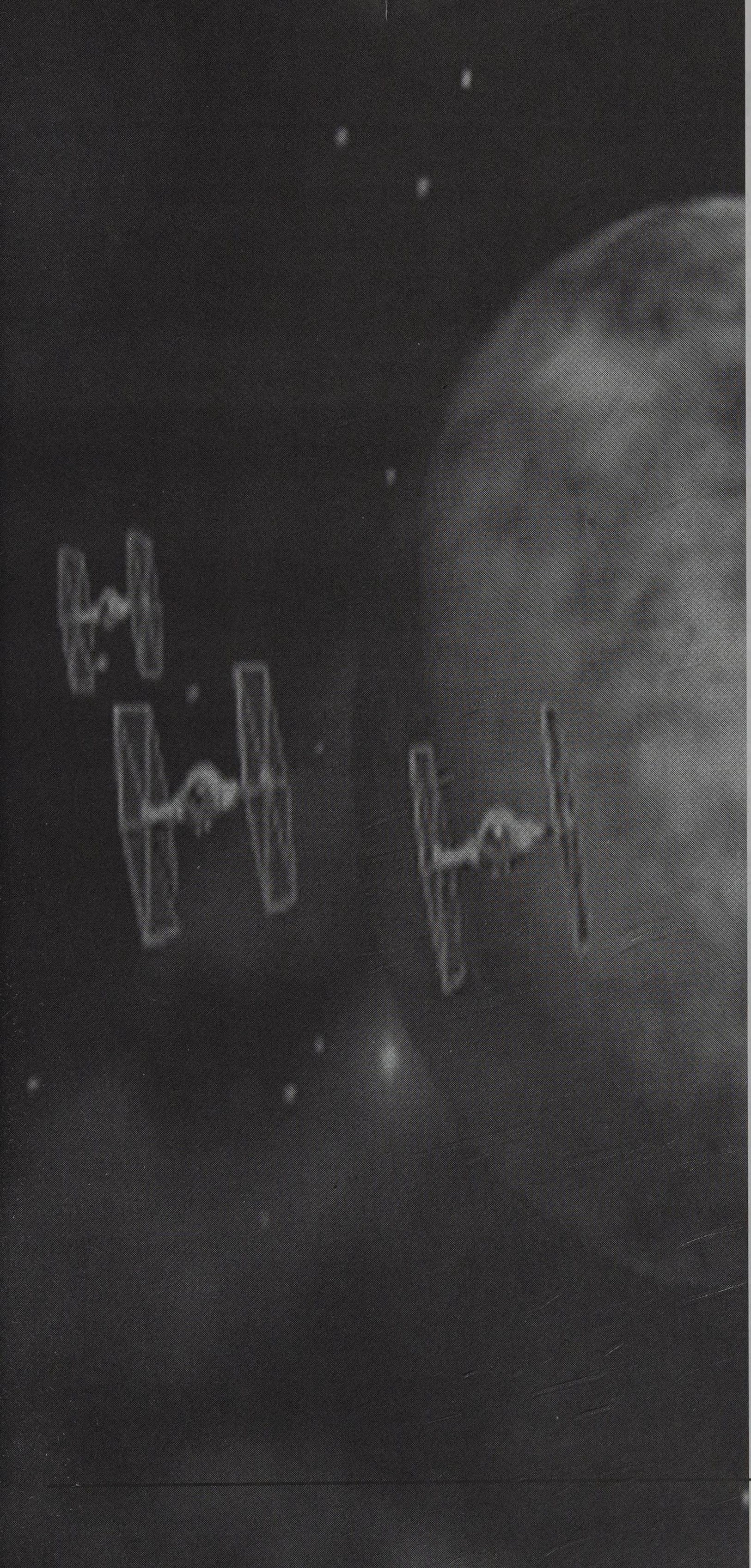
REBEL BRIEFING

Banding is a dreaded problem when going from 24- to 8-bit images. It happens when, for example, you have a shadow on a wall that moves gradually from gray to black. In 24-bit, that gradation will be very smooth. But in 8-bit, when you're forced to the gradation only 16 colors to work with, it creates definite bands of color on the wall instead of a smooth-looking texture.

D-Paint and Autodesk Animator Pro. You end up using a lot of different programs on any given shot because each of them does everything but the one thing that you need to do. I think that a lot of the tools overlook the 8-bit market, which is where games are now and probably will be for the foreseeable future, at least one to two years. Most of the new tools are 24-bit because they are for treating video images or print images, which require true color. But in both cases, they completely overlook the 8-bit world. DeBabelizer is one of the few that doesn't. It's designed to bring images back to 8-bit, so we can work with that. Ideally, after this project, our programming resources may have grown enough to the point where we can set some people aside and create our own tools.

Doug: Before I SMUSH video, I sometimes have to take it into an 8-bit paint program because there are some things that you can fix in an 8-bit paint program than you can't fix in a 24-bit program. We use V-Paint — that's a tool that Vince developed between *Rebel I* and *II*. It works a lot like D-Paint. It gives you the ability to have what we call animation layers, to have multiple animations layered on top of each other. It also has all kinds of bizarre tools that most artists don't need, but for one reason or another, we need when we're processing the shots.





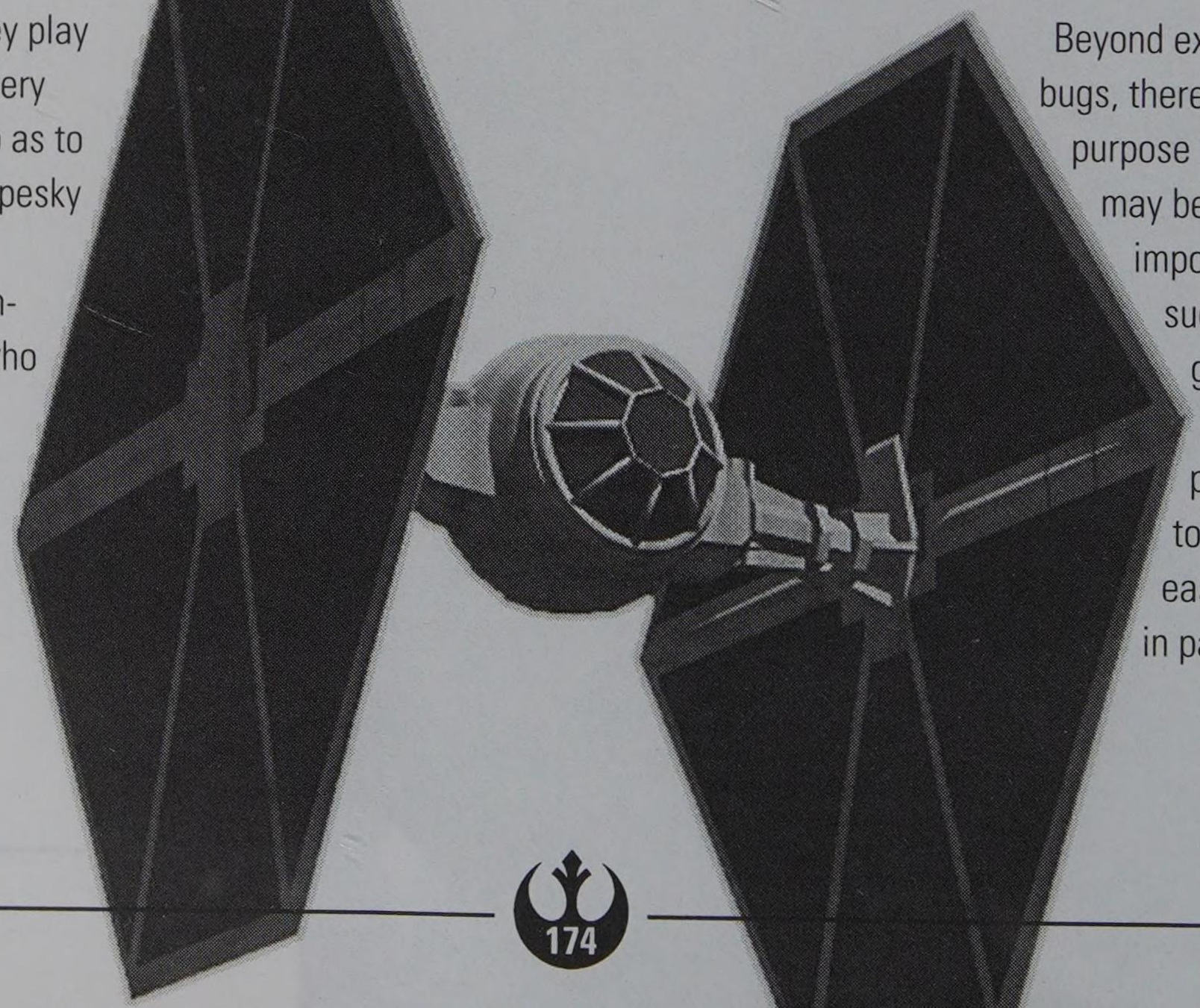
CHAPTER 9

TESTING 1, 2, 3...

Testing 1, 2, 3...

Bugs. They creep and crawl and nest inside even the most well-written computer code. The big ones can lock up your system in the heat of battle; the small ones might only make the colors on your screen less than perfect. Bugs are the Achilles' heel of all game programmers. These code masters can almost always fix a bug if they can find it — but finding it can literally be like finding a needle in a haystack. It can take days or weeks to find the culprit, and sometimes they're never found — then everyone has to live with the final flaw in the software. Bugs highlight a major difference between stable mediums like books and television and the very "fragile" medium of computers. A flaw in a book may be disappointing but it can't destroy the book or make it unreadable. But a flaw in a game can lock it up, make the game permanently unplayable, or even damage the computer itself.

However, one person's suffering is another's golden opportunity. Those tenacious, highly idiosyncratic bugs gave birth to a new technological species: the game tester. These people are the hardest of hard-core gamers. They live inside a game — or even a level of a game — for weeks on end. They play every section in every imaginable way so as to root out whatever pesky bugs lurk therein. There are also compatibility testers who play the game on whatever strange and wonderful computer systems the gaming public might wire together to determine if the game is playable on it. The testing period for *Rebel Assault II* lasted three months, a month or so less than the LucasArts protocol. That doesn't imply the game received inadequate testing. Instead, it means that with a take-no-prisoners goal of releasing the game before Christmas 1995, the testing group was expanded, and testing days (and nights) were lengthened. At the peak, seven game testers and three compatibility testers ran the game through its paces.



Beyond exterminating bugs, there is another purpose to testing that may be even more important to the success of a game — fine-tuning gameplay. Is it too tough? Is it too easy? Is it boring in parts? During

the crunch of completing a project like *Rebel Assault II*, designers and producers often don't have as much time as they would like to play the game. And playing is the only way to find out if it's any good.

I spoke with Brian Kemp, the lead tester on *Rebel Assault II*, about the role testing plays in the creative development — and perfection — of a game.

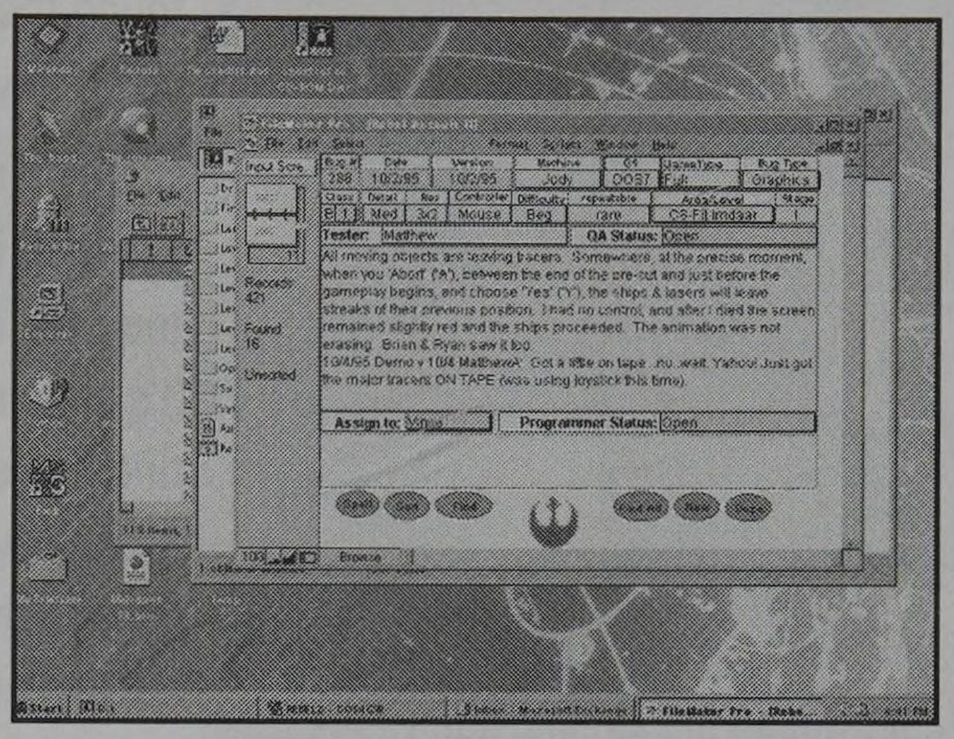
LOOKING FOR A FEW GOOD BUGS

What is a lead tester?

Lead testers manage the test team on a project. You coordinate which parts of the game each person will be testing, and you're the main link between the testers and the producer and lead programmer. When a programmer like Vince has questions about how a bug happens, he comes to the lead tester. We'll go back to the testers and say, "OK, show it to us, show it to the programmer, let's see how you did it, what room were you in, what were you looking at exactly when the bug happened?"

How big is your team on a project like *Rebel Assault II*?

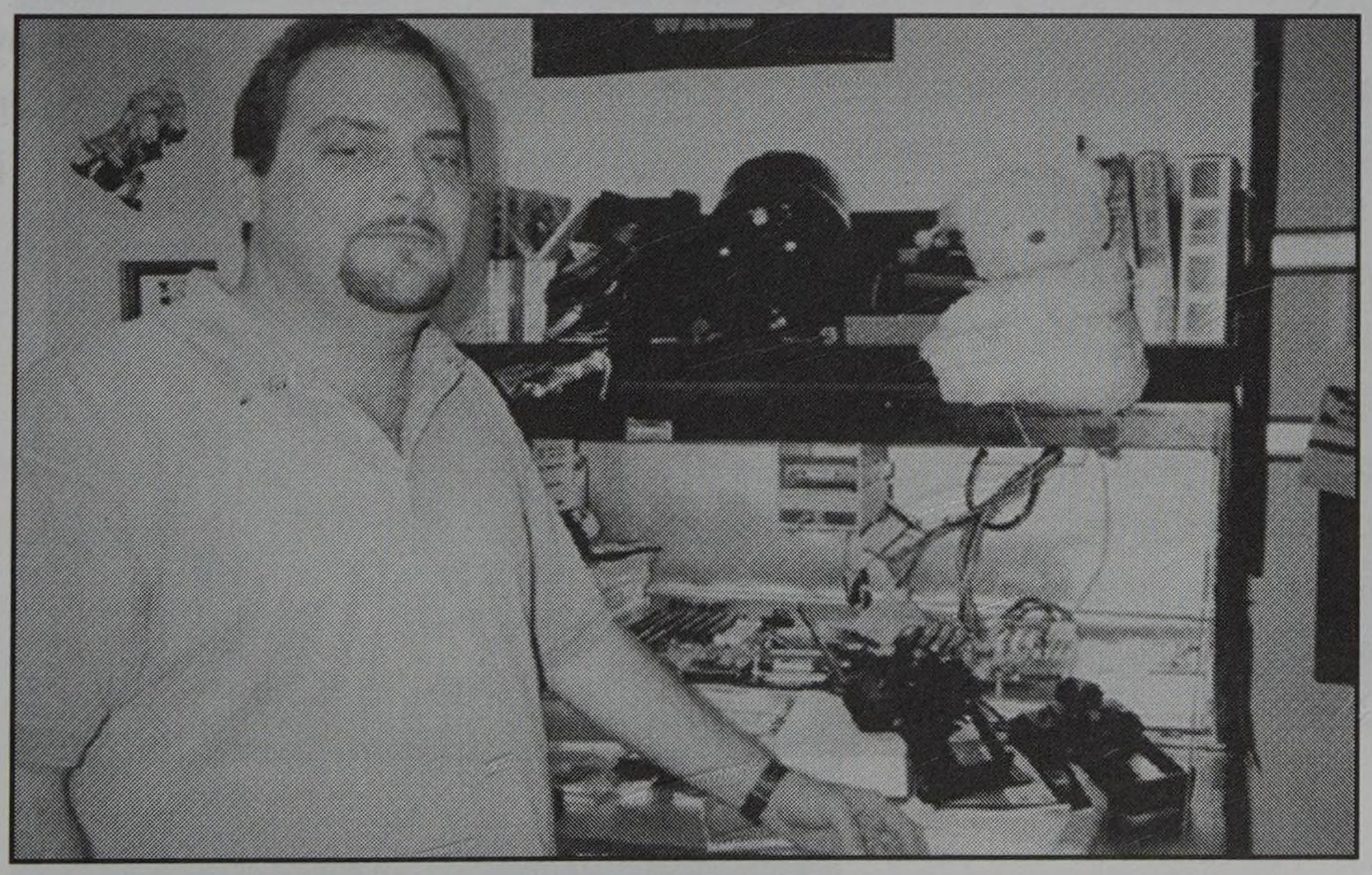
We have seven testers working on it, not including the compatibility testers who check the game out on different hardware systems.



LucasArts developed a bug-tracking system in FileMaker Pro.

How is the testing process organized?

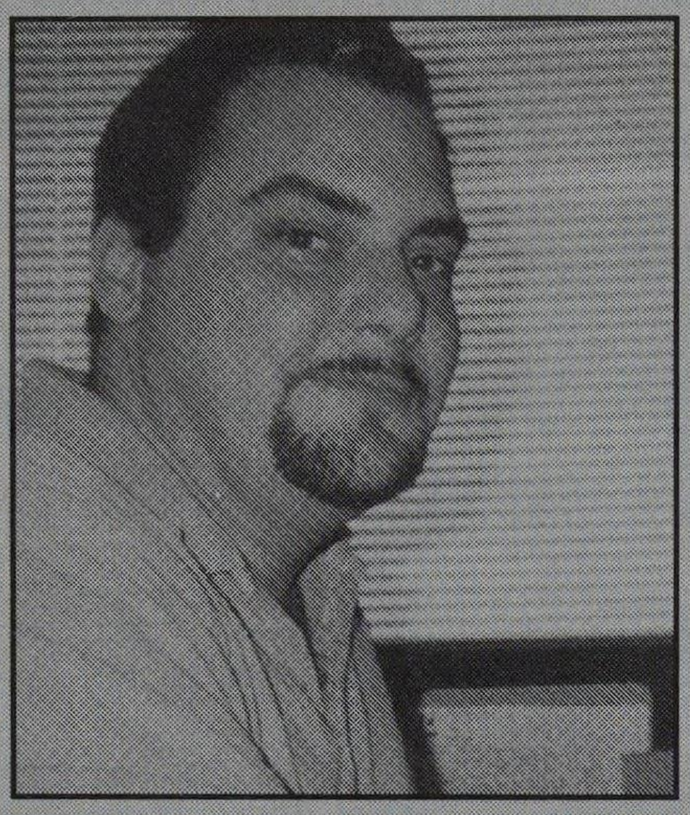
First, I'll come up with a test plan that goes through the game, level by level, step by step. It explains all the different features of the game and all the things a tester should check and look for. You know, make sure you hit every target, make sure it blows up, don't hit every target, make sure you take on damage.



Lead Tester Brian Kemp at his desk

REBEL PROFILE

BRIAN KEMP
Lead Tester



Brian Kemp

They call it The Pit, and it's where every game at LucasArts is put through the gaming equivalent of medieval torture. Before it is sent to retail shelves, *Rebel Assault II* must successfully run a gauntlet of jeans-clad, athletic-shoe-shod, T-shirt-wearing game testers. The Pit is dark (better to see the glowing game screens, my dear). The testers are young (better to watch millions of tiny pixels day after day). And there is a constant hum of laughter, banter, friendly insults, and collegial collaboration — not to mention game sounds and music. One thing is clear about the inhabitants of The Pit: These folks (mostly guys) are having fun.

In the old LucasArts building down the road, space limitations forced the testing department to be scattered among four or five different rooms. "But now we're all back in one location again," said Brian Kemp, the lead tester on *Rebel Assault II*. "And we are pretty happy about it. You can get very close to these guys, especially when you're in crunch mode and spending 12 hours a day, seven days a week with the same group of people."

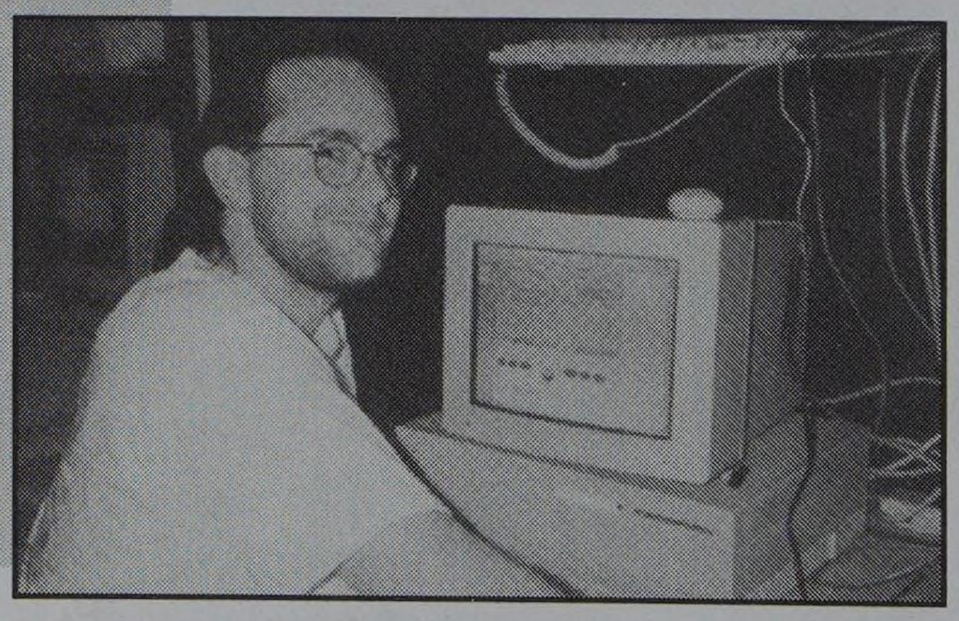
For example, there was a bug in the 3DO version of *Rebel Assault* where there was one target on the very last level, the Death Star level, where if you didn't shoot it, the game would just stop and lock up. That slipped by for a long while because it was natural to shoot that target. But eventually somebody didn't shoot it, and we found the bug. You have to try everything, including not doing anything.

Once the plan is set, it's just a matter of pure testing. We look for bugs, we make sure it's not playing too tough or too easy, and we make sure the game is fun. It's also trying every weird thing you can think of — hitting the keyboard a whole bunch of times, popping out the CD in the middle of loading the level, anything that a user might accidentally or purposely do to see what happens to the game. If you pop out the CD, for example, we have to make sure that there is a little box that comes up and says, "Please reinsert the CD."

When you find a bug, what's the fix process?

We track all the bugs that we find on an on-line data base that everyone has access to. The programmers have access to it, but usually it's easier for them if we give them an entire print out of all the bugs so that they can go through and check them off systematically.

Most of the stuff they say, "OK, yeah, this is happening," and they'll mark off the report, saying "fixed," or "repeat with new version," which means "I need some new information," or "I think I've fixed it but see if you

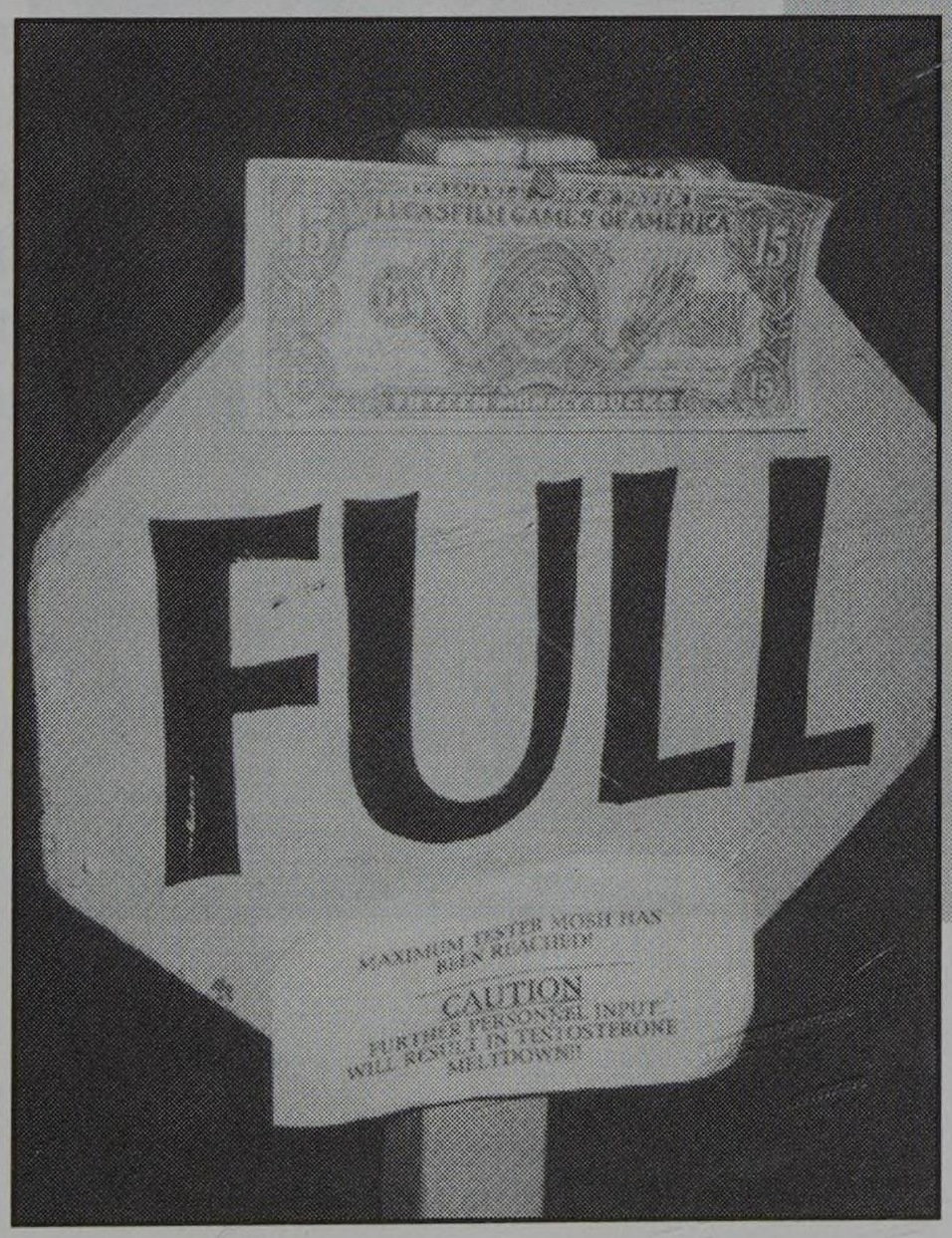


Brad Grantham

can do it again." When we get that report, we'll enter it into the database, and we'll hand "fixes to check" to all the testers, and they run them through the game to see if the bug is fixed, or it's not fixed and it's doing something slightly different. Or sometimes the problem just vanishes, it just doesn't happen anymore, no matter what we do.

In an ideal world you receive a beta version of a game — one that has all the features included but not perfected yet. Was that the case with *Rebel Assault II*?

We got this game pretty early in the process, earlier than with most games. I think when we first saw it two months ago, it had probably three or four levels out of 15 in it. Because the developers finish one level at a time, they can send it to test one level at a time. The art gets done, Vince wires it into the game and adds sprites and things you can hit and shoot and so on, and we get it shortly after. Now we have everything except for just one or two levels. We're getting a new version from Vince about every five days, and we're about a month away from signing off on it.

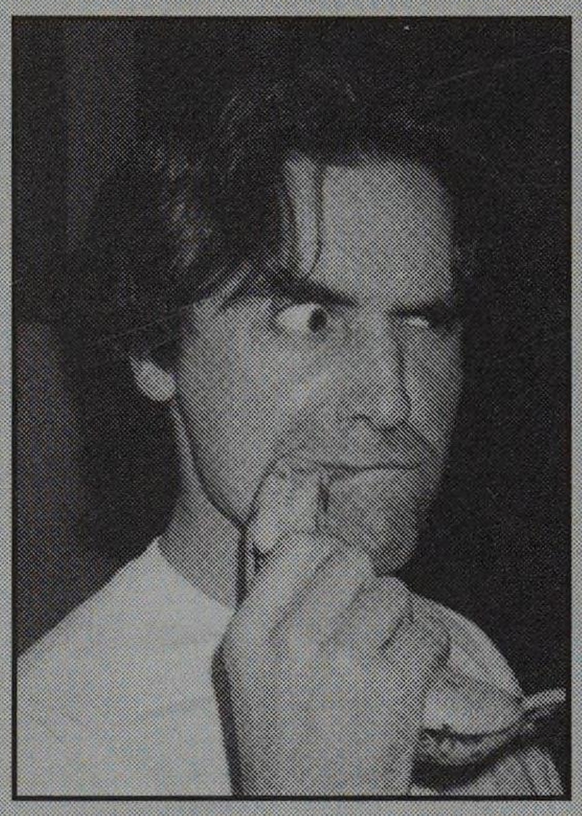


The testers maintain a sense of humor despite staring at a computer screen for hours on end.

REBEL PROFILE

BRIAN KEMP
Lead Tester (continued)

Normally the testers work a standard 9-to-6 day because they need to be around when the programmers and management are in the building. "But we start to get a little bit into vampire hours as crunch time wears on," Kemp said. Most of a tester's typical day, as might be expected, is spent at the computer screen playing games. They read a little E-mail, then divide their time between searching for bugs and going through "fix to checks" to see if reported bugs have truly been exterminated.



Bugs are driving Matthew Azeveda bananas.

One might think that the sameness, perhaps even monotony, of staring at a game screen all day might cause a rapid turnover in the testing department. But that's not true at LucasArts, said Kemp. "There are always people who are being promoted and moving up into other areas within the company," he says, "but there's actually not a whole lot of turnover in testing. There are definitely some people who really like it here and really enjoy playing games."

REBEL PROFILE — BRIAN KEMP
Lead Tester (continued)

Before he entered The Pit, Kemp was trying to make it as a public radio reporter working at station KPFA in San Francisco. "Then I decided I didn't want to move to One Horse, Montana, for my first gig, so I got into this."

His lifelong interest in computers started when he received a Commodore Vic 20 at age 12. "I played a lot of games, but I was just interested in computers as a toy you could control. There was some interest in figuring out why they worked and why they sometimes didn't work. Maybe that was the genesis of my becoming a tester."

Even though Kemp grew up on the other side of the hill from Skywalker Ranch and knew it was "a good gig to get into," he never thought he'd have a chance to work at LucasArts. Then he met a friend from junior high school who worked at the company "and the rest is history." He started working as a freelance tester on *TIE Fighter,* then became lead tester on *Defender of the Empire,* the expansion disk for *TIE Fighter.* That was followed by heading the testing for *Indiana Jones' Greatest Adventures* and working on several different versions of *Rebel Assault.*

After two years in The Pit, Kemp knows what makes a good tester. "Computers are real stupid," he says. "If you don't do exactly what they expect you to do, they can't handle it. So as a tester, you're always trying to push the machine, to see what it's going to have

How does a game qualify to be signed off?

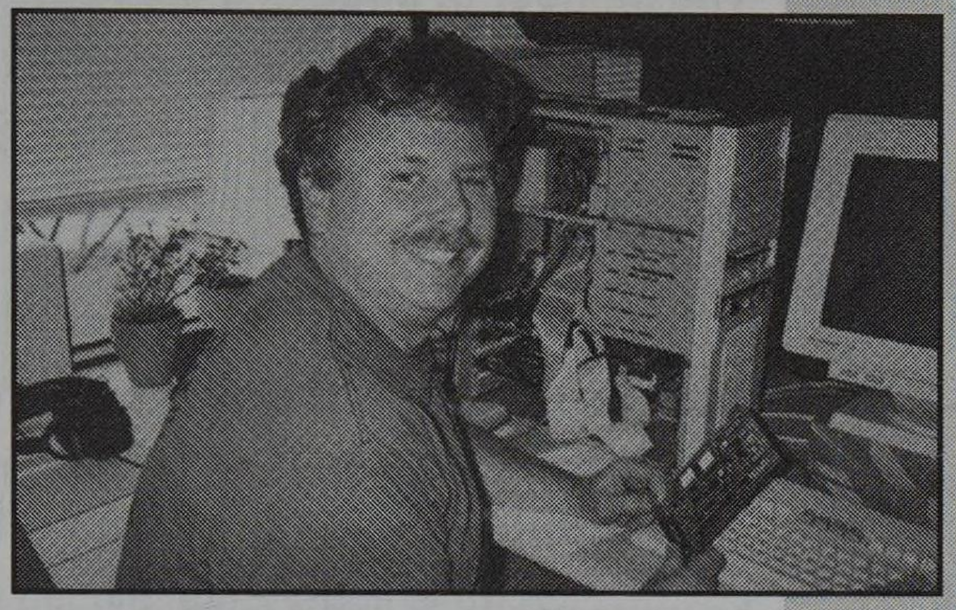
That means that every bug or problem that can be signed off by the ship date has been fixed and signed off by the programmers and producers. There may be certain very minor things that are still wrong, but not anything that would crash the game. When we do the sign-off, we'll go over everything, any outstanding bugs, anything minor that's still in there, and then the developers and the producers will determine if we can live with them — and we send it out the door. If not, the programmers fix them.

Sometimes there are minor bugs that we spot too late in the process — say, the shading in one screen is a little bit weird, or there's a bit of an art problem somewhere, but we just have to go with it. And sometimes we find bugs that aren't really bugs — the program just wasn't designed to do what we think it should do. There's nothing the programmers can do about that.

Sometimes we also put together a list of different hardware that the game has had some weird problems

LucasArts has a closet full of video boards to test for compatibility

with. Certain hardware you have to mess around with in order to make it work with the game, so we'll document the hardware we've found problems with and hand it to the product support department. If we know that there's a problem with some equipment, product support will be able to tell them what they can do to fix the problem.



Scott Douglas gets ready to plug in a new board.

Is *Rebel Assault II* the type of game that generates lots of bugs? How does it compare to other games?

With *Rebel Assault II*, because it's a game with streaming video that you control less and experience more, there aren't quite as many bugs, but there's still stuff that comes up.

For example, there may be a problem with the snap distance on a level. That's a feature that lets your cursor lock onto a target even if its not directly on the target. The higher the snap distance, the further away your cursor can be before it "snaps" into the lock position. Maybe the distance is too far on this level, which makes the level too easy.

REBEL PROFILE

BRIAN KEMP
Lead Tester (continued)

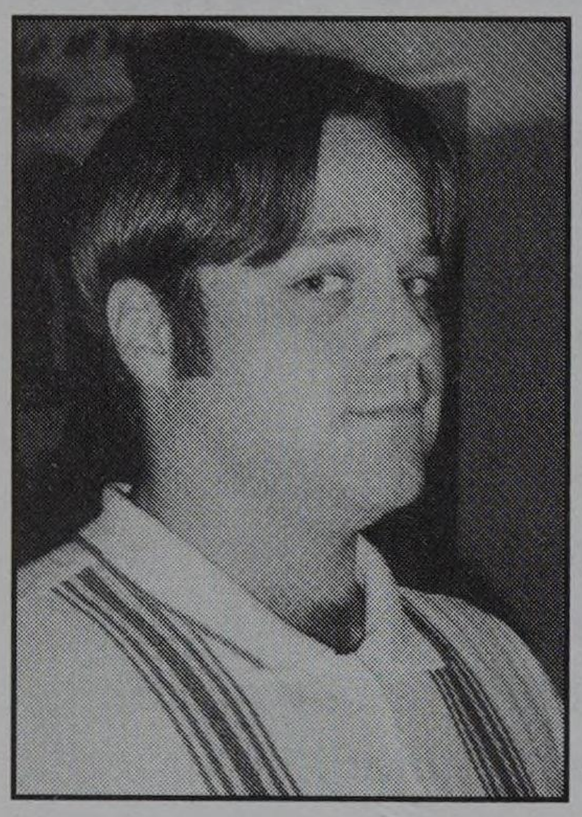
problems with — and you have to like doing that. You have to have some tenacity. You also need some aptitude to handle repetitive stuff because you are playing the same game over and over, and you may play it through a couple hundred times during the course of testing. But you also need an eye for detail because you need to be able to see the things that break down from version to version. Even though you may have seen the same scene thousands of times, you need to be able to notice something that's even slightly different.

"Most importantly, you have to have a definite joy of playing games and video games. There are quite a few people around here who play paper-based strategy games. They just like games, and that gives them some creativity in how to play the games."

It's his love of games that keeps Kemp in The Pit. He maintains his interest in voice work, has a "fun hobby" of recording movie and television show bits for computer start-up sounds, and eventually might like to move into designing sounds for video games, but he's happy — and busy — for now with testing. "I've thought about going back to volunteer at KPFA," he said, "but this place just seems to take all of my time."

And everyone who's ever had a game crash knows that it's time well spent.

Right now we're at the stage where not all of the sounds are in place, or they're just coming in, and so there are a lot of sound bugs. There may be ambient sounds in the background, or a lack thereof. Or some of the sound effects may need to be altered slightly. Or there are technical issues with the sound — it just isn't playing right, it sounds distorted, or not what it should sound like.



Tester Chris Snyder

We've got one bug right now where every once in a while on a level the game is not clearing the screen as you fly. It's one of the levels where you're shooting down TIE fighters, and what happens is the image of a new TIE fighter will move across the screen, but the old image isn't erased. And when that happens, you get these tracers of the fighters, and then the screen gets red because you get damaged and it's not clearing that off either. So you end up with this screen that you might use for some light shows in the city. The game still thinks that it's playing fine, but something is definitely wrong.

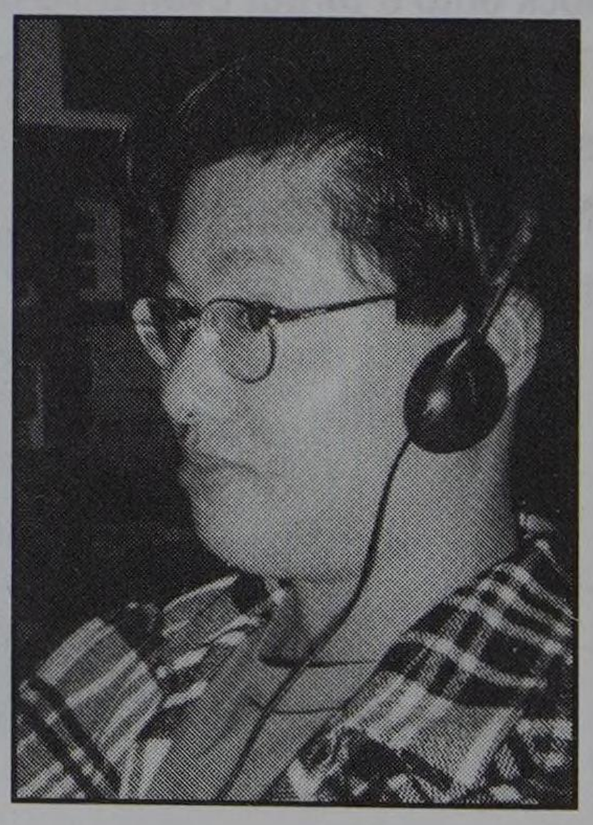
On something like this, which is so bizarre, I'll ask Vince to stop by when he has a minute, and we'll show it to him. We try to videotape the games as well. It's good to do because then the programmer can see exactly what steps were happening so that he can track it through which area of the code is acting up. He can see that "this animation is fine, this animation is fine — oh, so that's where it goes bad."

The number of bugs in a game must also depend upon the skill of the programmers and how "clean" their code is. How is Vince in that regard?

The programmer definitely makes a difference. Vince is really good. [Laughs.] I mean, there are some bugs that come up and Vince will say, "I don't know, I can't fix it." Then two days later we'll get the bug report back and he writes on it, "I lied, I fixed it."

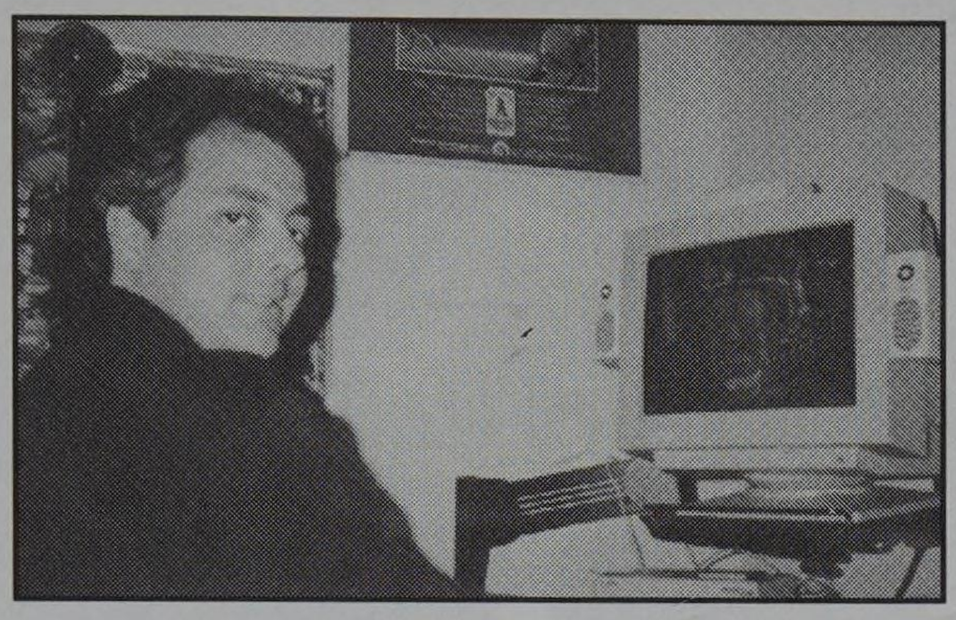
You mentioned compatibility testing. On how many different types of computer systems do you test a game like *Rebel Assault II*?

We'll try it on maybe 15 different systems just within the testing department — more than the amount of testers on the game — but we'll have people switching machines over the course of the project. We'll set up a special base machine. The minimum requirement is going to be a 486 computer that runs at 50Mhz with a



Albert Chen and all the testers wear headphones so they don't disturb their neighbors.

double-speed CD-ROM drive. So we set up a 486, 50MHz machine with a lower to midrange CD-ROM drive and an older video card. And we'll make sure that the game is playable on that. Then we also have a com-



Jim Davison, one of the compatibility testers.

patibility department, which is three full-time people and three part-time people right now. They'll go through 50 to 100 different video cards and every kind of CD-ROM drive they can get their hands on to make sure the game works on all this different hardware.

JUST MAKE IT FUN, BABY

Beyond exterminating bugs, how does the testing process improve the final version of the game?

With *Rebel Assault II*, there's a lot of difficulty tweaking you can do. In fact, Vince includes a Difficulty Editor in the game so that you can actually go in and adjust how much damage not hitting a target does, how hard it is to hit a target, how many enemies you face in a different stage. So testing can really go through that and use the Editor as a tool to tweak the gameplay.

Because Vince is so crunched for time right now, we've actually been testing different difficulty settings for different levels that we prefer, then handing them over to him and saying, "What do you think of this?"

Testers often say that a level is just not fun, too easy, or too hard. They can come up with suggestions and tell the programmer, "Well, what if we did something slightly different."

"In a graphic adventure, for example," Kemp said, "we can tell them when a puzzle is just too tough and suggest what can be done to make it more fair."

While Kemp and the rest of the testers admitted Rebel II was solid from the beginning, they did have a few suggestions that were incorporated. You have them to thank for allowing you to configure the joystick on the fly.

They also found the first version of Chapter 13 far too easy. Originally, you only needed to shoot the shields to escape from the tunnel. They found the targets were easy to shoot, and you'd heal as you flew

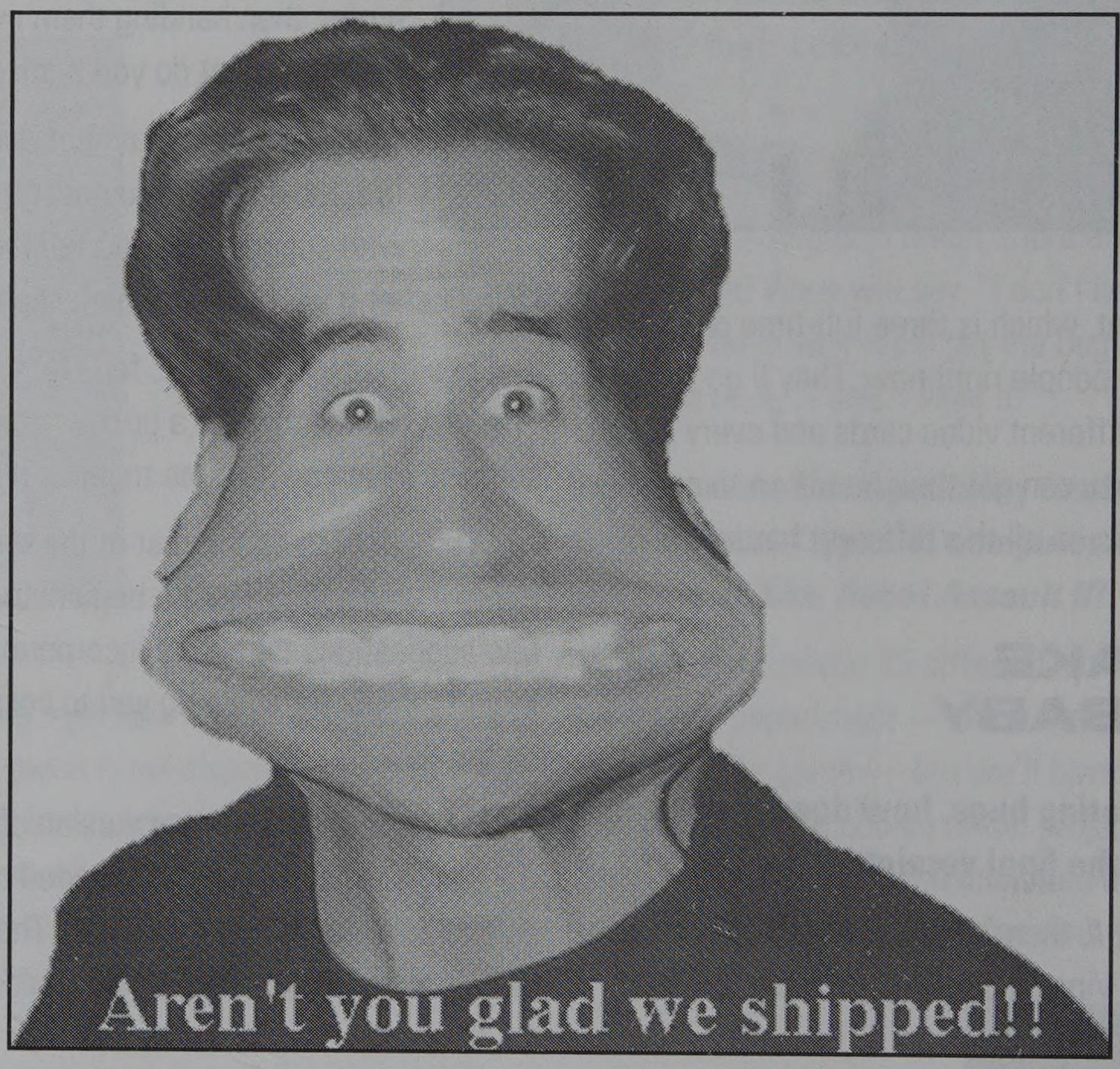
The first version of Chapter 13 was too easy; the testers suggested a droid that shoots electricity.

around inside. They suggested adding something that shoots at you. Vince and the rest of the team added the sneaky droid, but they forgot to give it firing capabilities.

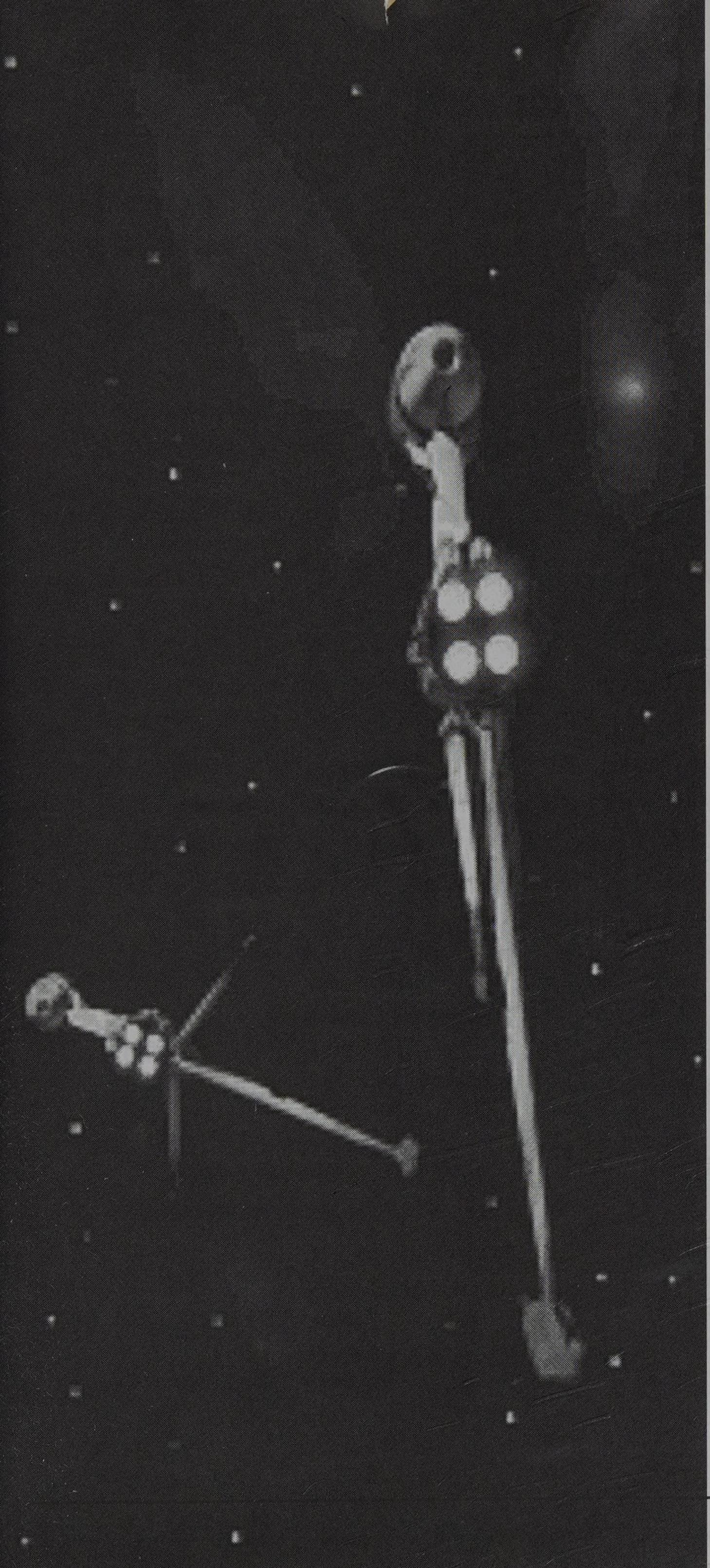
In the 11th hour, just as the game was getting ready to go to manufacturing, Doug Shannon went into V-Paint and created an image of lightning.

It's these kinds of contributions — plus squashing any and all bugs — that make the men and women in The Pit invaluable. They are the last line between manufacturer and consumer.

And you thought they were just playing all day.



It's smiles all around when the game gets out the door.



APPENDIX

GAME CREDITS AND CAST

Game Credits and Cast

Rebel Assault II *is a phenomenal accomplishment, and like all such accomplishments, it was a team effort. While we've focused on but a handful of the key players, this game would never have been finished — or look as good as it does — without the talent and dedication of all those listed here. Kudos to all.*

GAME CREDITS

Project Leader/ Programmer/Designer	Vince Lee
Visual Design/ Lead Artist	Richard Green
Art and Animation	Ron K. Lussier, Garry M. Gaber, Daniel Colon Jr., Eric Ingerson, Craig Rundels, Clint Young, Seth Piezas, Jon Knoles, Bill Stoneham, Alan Iglesias
Additional 3D Art Provided by Mechadeus	Noah Kennedy, Goose, Thom Bishop, Marco Bertoldo, Bill Neimeyer, Cody Chancellor, Eric Chadwick
Lead Video Effects Compositor	Mark Christiansen
Lead Art Technician	Aaron Muszalski
Video Effects Compositor	Chris Weakley
Art Technician	Doug Shannon
Storyboard Artist	Paul Topolos
Director of Live Video	Hal Barwood
Additional Video Production Support	Laurie Blavin, George Young, Joyce Quan, Rick Wise, Jim Rolin, Patrick Sirk, Mike Dondero, Lisa Ginsburg, Blake Tucker, Nelson Hall
Sound Designer	Larry the O
Sound Quality Control	Peter McConnell
Composer and Conductor of Music	John Williams, Performed by the London Symphony Orchestra Star Wars Trilogy: The Original Soundtrack Anthology ® © 1993 Lucasfilm Ltd. Used Under Authorization. All Rights Reserved.
Voice Producer/ Director/Casting	Tamlynn Barra
Voice Editor	Khris Brown
Assistant Voice Editors	Coya Elliott, Julian Kwasneski
Voice Production Assistance	Peggy Bartlett
Additional Windows Programming	Matthew Russell
Additional Macintosh Programming	Aaron Giles
Bootmaker Programming	Paul Lefevre
Director of Production	Steve Dauterman
Production Coordinator	Llesllе Aclaro
Quality Assurance Manager	Mark Cartwright
Quality Assurance Supervisor	Dan Connors

Lead Tester	Brian Kemp
Game Testing	Matt Azeveda, Chris Snyder, Brad Grantham, Sean Matheis, Janene Gunning, Albert Chen
Lead Compatibility Tester	Chip Hinnenberg
Compatibility Testing	Amy Coffman, Doyle Gilstrap, Jim Davison, Anthony Burquez, Scott Douglas
Quality Assurance Archivist	Wendy Kaplan
Product Marketing Manager	Barbara Gleason
Public Relations Manager	Sue Seserman
Public Relations Specialist	Tom Sarris
Cover Art	Bill Eaken
Package Design	Soo Hoo Design, Richard Green
Manual Design	Shepard Associates
Documentation	Brian Bonet, Johnathan Jackson
Special Thanks to	George Lucas

THE CAST

Rookie One	Jamison Jones
Ru Murleen	Julie Eccles
Admiral Sarn	Gary Martinez
Imperial Officer	Howard Swain
Captain Merrick	Roy Conrad
Admiral Krane	Craig Lewis
Ensign Till	Michael Aron
Commander Jenn	Zachary Barton
Cargo Captain	Marc Bauman
Commander Kirby	Chopper Bernet
Ina Rece	Nicole Galland
Darnell Reggs	Carl Magruder
Darth Vader	C. Andrew Nelson
Stormtroopers	Marc Bauman and Carl Magruder
Admiral Ackbar	Himself
Rebels	Mark Christiansen, Laddia Holly, Garrett Griffin, Kathy McGinley, Howard Meshan, Marilyn Moeten, Ron Rogge, Greg Scott, Carolyn Taylor, Matthew Troncone, Blake Tucker

Voice Overs

Intercom and Red Shirt One	Denny Delk
Emperor	Nick Jameson
Stormtroopers	Nick Jameson and Colin Michael Kitchens
Darth Vader	Scott Lawrence

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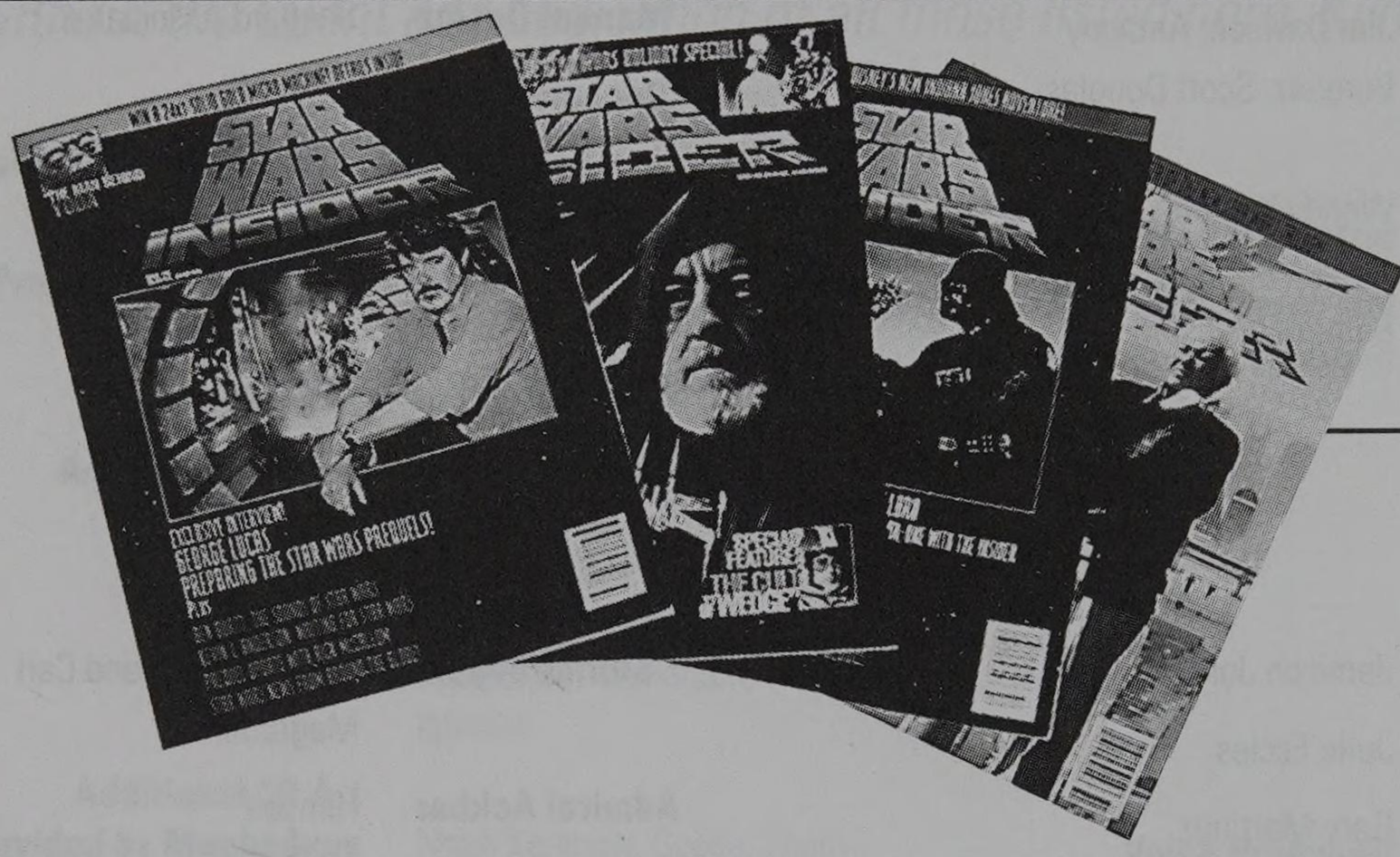

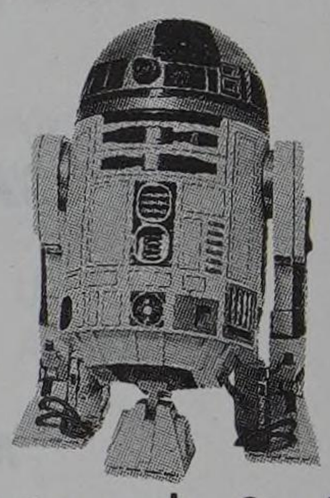

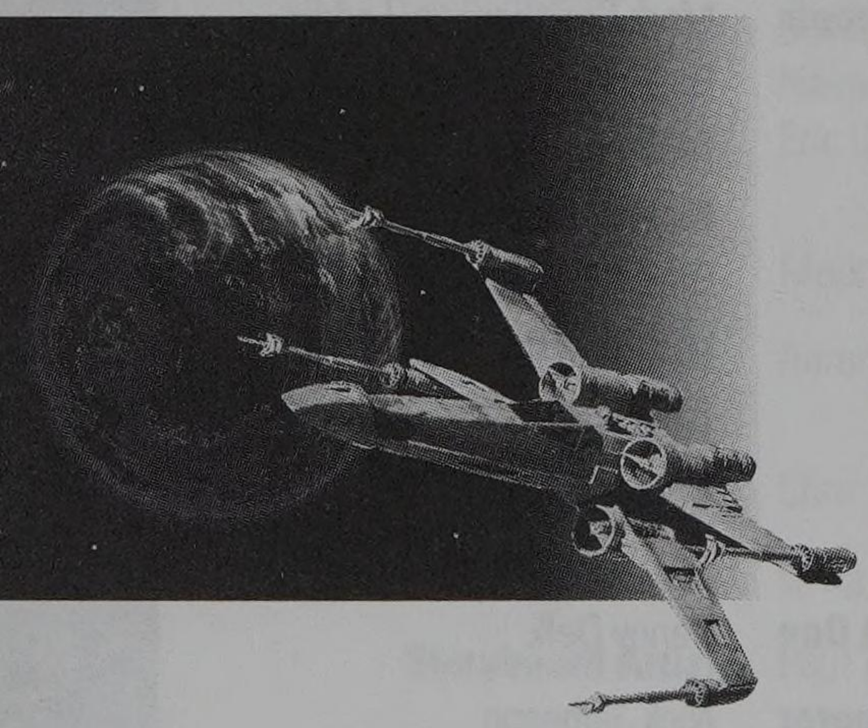

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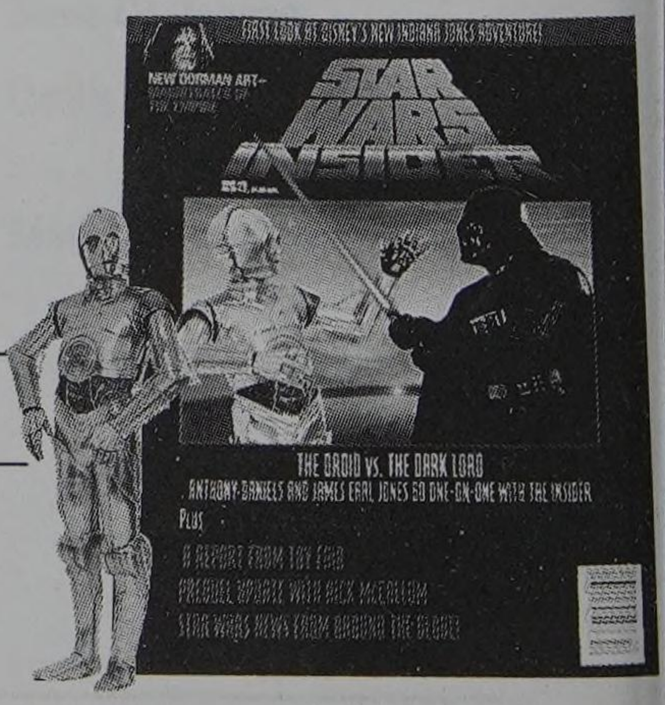

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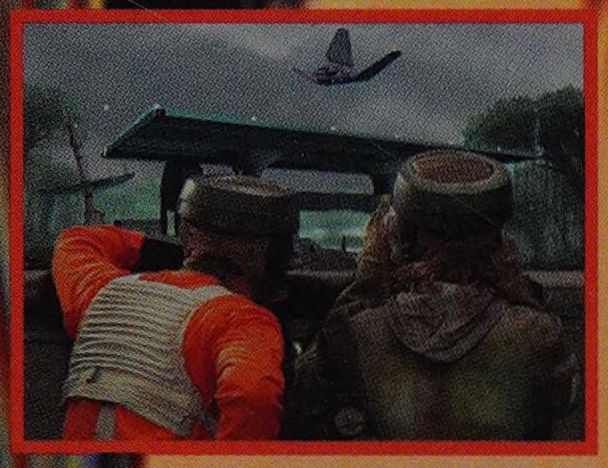

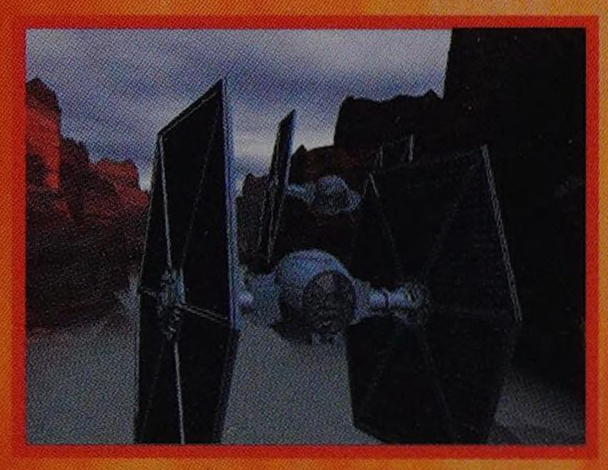

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