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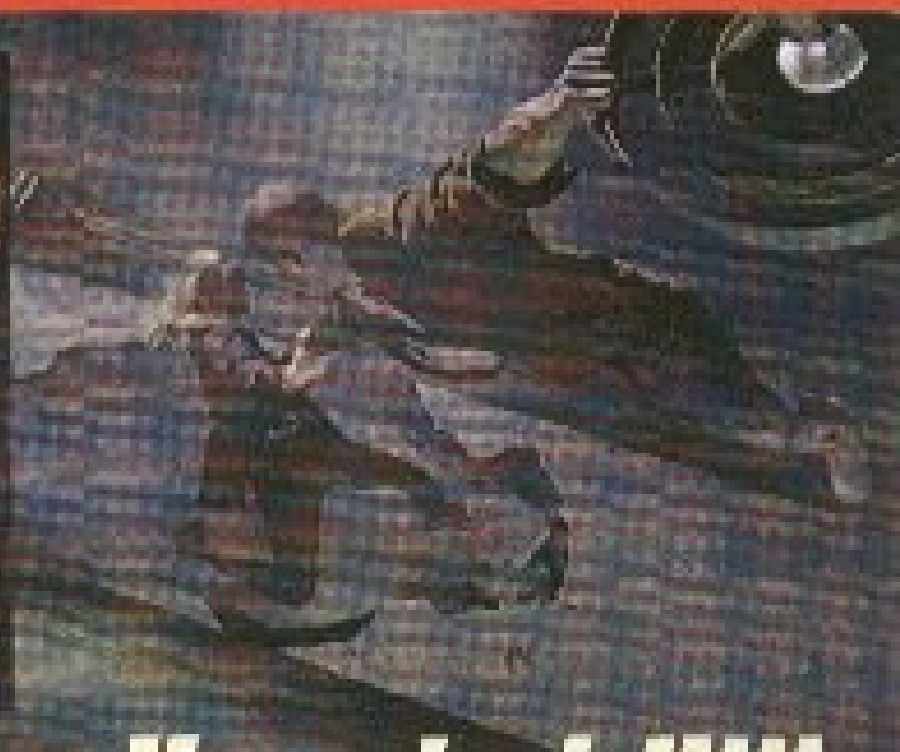

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Texturing the hardware for **S:AAB**

*Masudaya re-modelled—***I,IS Robot**

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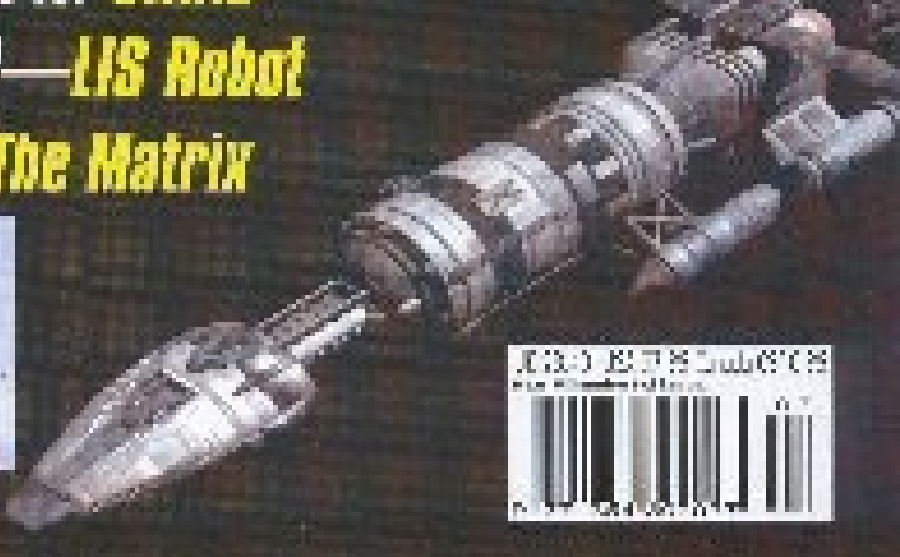

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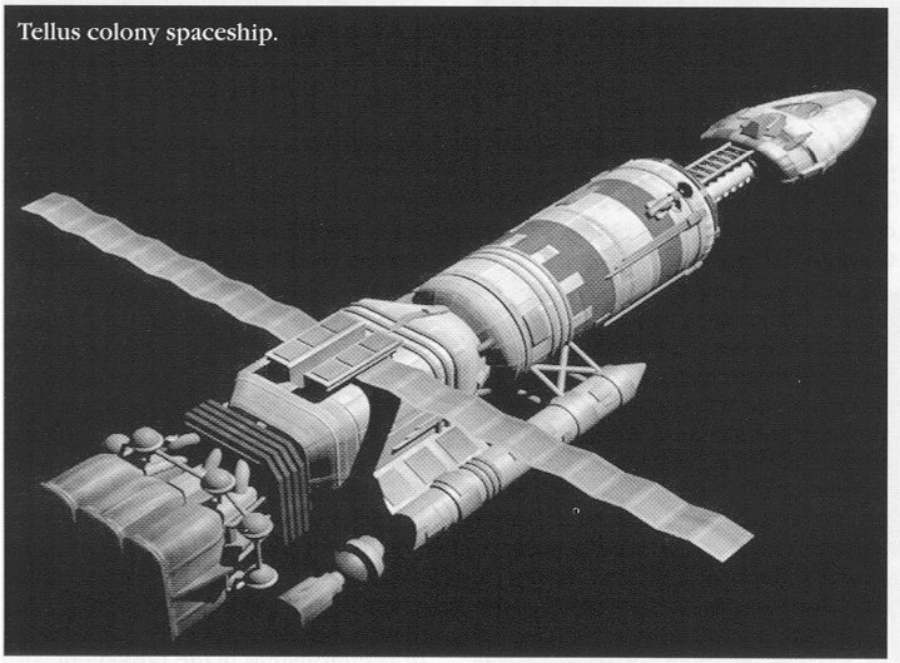
The Digital Magic of Space Above and Beyond:

Surfacing

An Interview with Karl Denham
wes sargent


Tellus colony spaceship.

All the way from T-shirts to* Titanic, *Karl Denham has been fortunate enough to be a part of some remarkable projects. Karl is a skilled Visual Effects Animator/Supervisor who also does a lot of 2-D compositing at* Station X Studios. *Amongst his former colleagues at* Area 51, *his pioneering work on the television series* Space Above and Beyond *earned him the reputation as a master of textures.

WS: Can you tell us a little about your background before you arrived on **Space Above and Beyond**?

Denham: I was a student at *Parson's School of Design* in New York and I also attended a school of visual arts where I majored in illustration. I actually did illustration work for about five years. Much of that was for various magazines and newspapers. I also had a T-shirt business for many years which I was very happy to eventually get out of (laughs). And I've always just worked on computers. I started out with games and just played with them.

WS: Was **SAAB** your first job as an animator?

Denham: No, my first one was working on a show called **Battletech**. It was all about these giant robots. It was a terrible animated series for kids. But it was a good learning experience. That went one season and then, when it got canceled, I left Chicago and came back to L.A. to work on **SAAB** at *Area 51*. I was originally hired just to be kind of an all purpose guy like most of the people there. I knew how to model. I knew some texturing. I knew how to animate. I wouldn't say that I was a super, super expert but I knew some stuff. I don't think when I was hired the guy who hired me really knew what I could do and, to be honest, I don't think I really knew what I could do either (laughs).

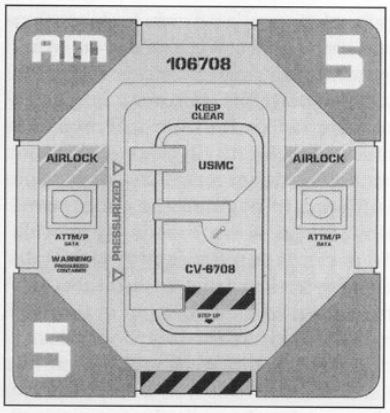
WS: Where did you learn how to animate?

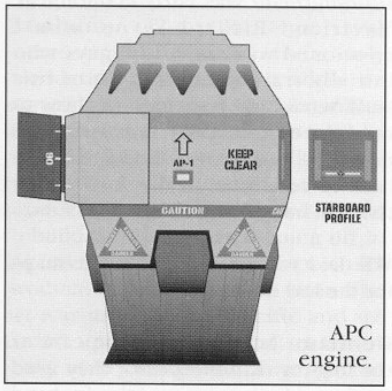
Denham: I had taught myself some stuff. I also gained a lot of experience working on **Battletech**. It had a lot of character animation with walking robots and things, so I was able to do a lot of walking, running, falling and reacting to hits. It wasn't super sophisticated animation but it was definitely an experience that I learned a lot from. So when I came into *Area 51* I was kind of ready to roll. I was really interested in texturing. I had done some stuff for a **Battletech** demo the year before with a friend of mine, Richard Payne, and it came out looking pretty good. Richard was also at *Area 51* but he left very shortly after I got there so he really didn't get to work on the whole run of **SAAB**.

We started by building models. Ken Stranahan built the *Hammerhead* but, as you know, computer models without textures look like plastic. They really don't look very good. I just basically asked them if I could take a crack at texturing it, which is what I did. We had to make it as realistic as we could and so we really tried to stay away from the CG look. In the end I think everybody was pretty happy with the result. I know I was.

WS: In another publication, Tim McHugh graciously described you as some kind of texturing god. Would you say that surfacing is one of your strongest suits?

Denham: Yeah. (laughs) I remember that article. That was kind of a cool time because after I did the *Hammerhead*, I think I kind of amazed myself as well. To be honest, I really didn't think that I was going to be able to do a nice job





APC engine.

until I saw it finished. There was a lot of sweat, working all night and busting my ass trying to get it done. Everybody seemed very happy with it so the texturing stuff just kept coming my way. I ended up texturing most of the major models on that show and I really enjoyed it. Scott Wheeler modeled the *ISSCV* which was the *Armored Personnel Carrier*. He totally wanted me to texture it which was nice. That made me feel good. It's really fun taking something and making it look like it's been through battle. Making a model look burned from entering the atmosphere or shot at with all the carbon scouring became one of my specialties. I also animated a lot and modeled quite a few things.

WS: In those days, many of the CG ships on television seemed to rely heavily on the diffuse channel for panel details. You took a different approach on **SAAB**.

Denham: Yes. But we also didn't use a lot of generic tilling maps either. As an example, the *Hammerhead* diagrams had very specific panel lines. We wanted it to look like a real plane and a real plane doesn't have a whole bunch of little generic panels all over it. We were very careful not to emulate that style. We knew we were going to be cutting with gritty but realistic live action. I always found it kind of jarring when other shows would cut from live action to stuff that's extremely CG looking. Everything was very specifically custom painted for each part of the model. Normally that wouldn't happen because it would be too time consuming and you would end up dedicating too much memory and resources for one model. Whereas, if you had a nice generic texture library, you could have thirty models all sharing the same textures. Which isn't always bad. In some cases I think it's a really good solution. For something like the *Hammerhead* which we knew was going to be a hero, we had to make it look as real as possible so we avoided that generic look as much as we could. At the time, we were really pushing the technology to the edge.

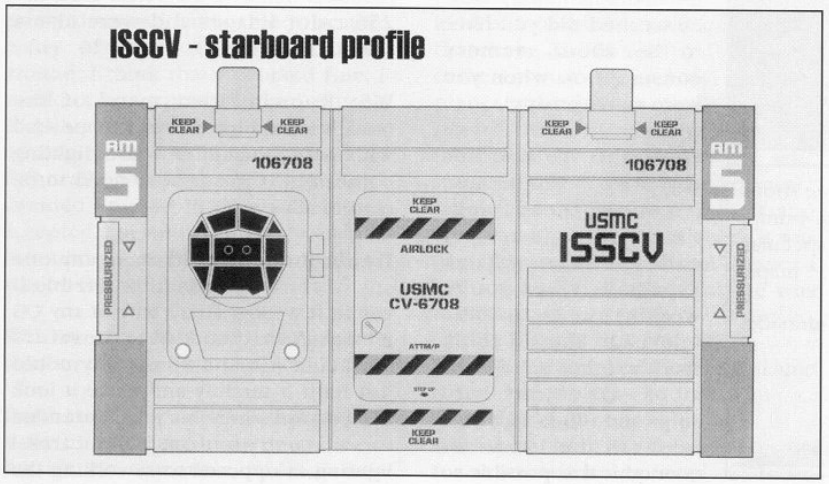
To give you an idea of how I would go about texturing a model, I would first break it into quite a few surfaces. Then I would paint a really detailed color map and back in those days you couldn't layer surfaces like you can now. At least not as easily. You had to do all kinds of wacky stuff which I didn't know how to do so I certainly wasn't going to do it. The color map would have all the chipped paint and scouring in it. A lot of people use the diffuse channel for dirt and burns. Unfortunately, that gives you basically gray scale dirt and burns which I don't particularly like. Generally, dirt has color in it. If something's scoured from being burned, most times there'll be blue, green, maybe oak and all kinds of other colors in there. So I would do a lot of that work right in the color map itself.

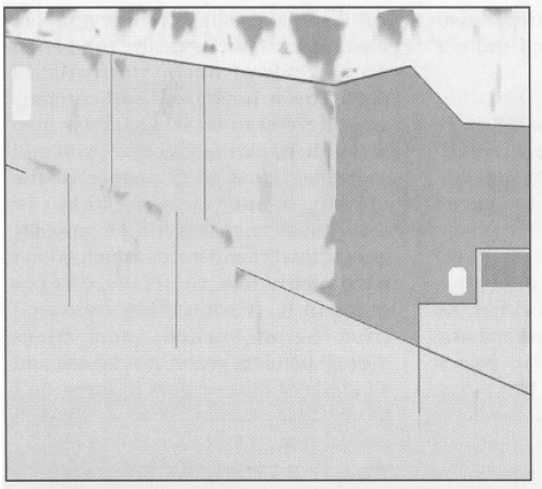
If I were working on a wing, for example, I wouldn't try and do an overall map that I could stick over the entire top of the ship. I would specifically paint an image that fit that wing exactly. Once that was done, the thing's already going to look kind of cool but it wouldn't be quite there because you wouldn't have the nice bumping or specular hits. You could still use the diffuse channel and I still did use it but I didn't like relying on it entirely for all the dirt and stuff. Once I had a cool color map, based on the kinds of wear, chips and scratches it had, I would then use it as a reference for how I'd create the specular, bump or diffuse. So every surface had its own color map, bump map, specular map and, in some cases, a diffuse map. Certainly they always had the first three.

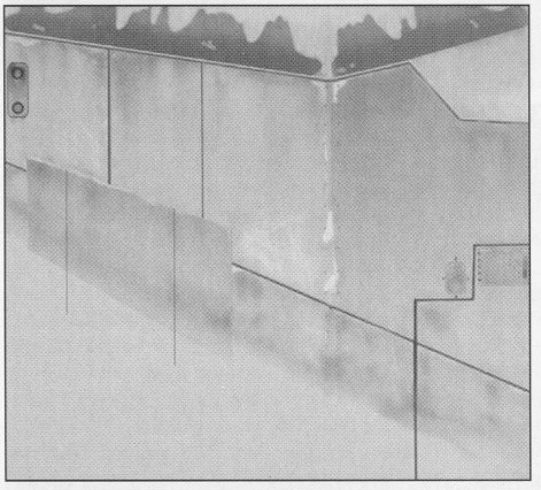
WS: It's been said that one could get up to a foot away and the ship would look completely photo-real.

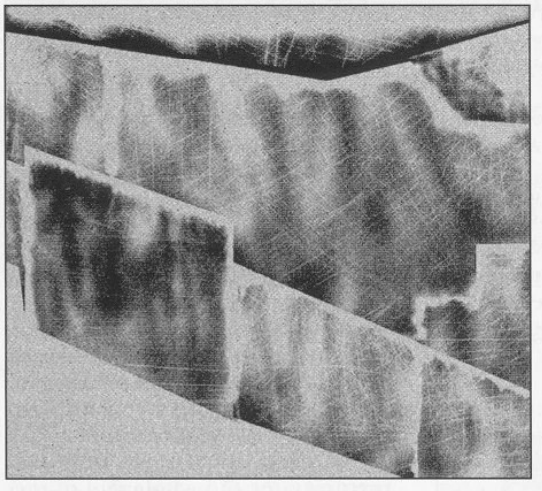
Denham: It seemed to hold up really well, I think. For its day it was one of the more photo-realistic things that you saw on CGI television. And yes, we did do shots where you'd get right up on the model and I used to cringe every time I saw a wireframe of somebody doing that because I'd be afraid I'd have to repaint the thing. We actually got away with the initial texturing for the whole run of the series. I got lots of compliments so it seemed like people were pretty happy with it. I didn't hear of anyone saying, "Oh boy! Those textures really didn't hold up." So that was pretty gratifying. It was basically *Lightwave* out of the box. I wasn't using fancy plugins or anything like that.

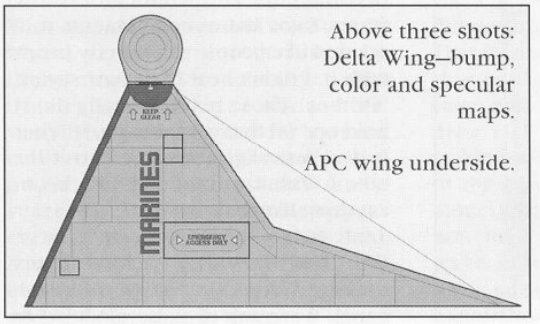
WS: The *Hammerhead* has many indented lines that separated each panel. Were any of these modeled or











Above three shots: Delta Wing—bump, color and specular maps.

APC wing underside.

did you do it all with bump maps?

Denham: Those are actually gigantic super sampled bump maps. I would make a huge map because one of the things that we found was when you created a bump map for lines like those, even if the lines are anti-aliased you got a really horrible looking line. So I actually made ones that were just massive. You could probably cover a whole wall with them. They were just two colors, black and white, so they were still fairly small, memory wise. We ended up getting a nice crisp line as opposed to the really soft ones you'd get if you anti-aliased them. Generally, if maps had sharp lines I'd just try to make them bigger but I think, for most of the other textures, we turned the anti-aliasing on.

WS: How many maps would you say the *Hammerhead* model contained?

Denham: That's a really good question. Somewhere in the neighborhood of forty maybe. I wouldn't be surprised if it was. I remember breaking that thing up into quite a few surfaces.

WS: You mentioned you were really pushing the limits of technology. How concerned did you have to be about memory consumption when you were making maps?

Denham: To me it's always a concern because it's one of those things that can just get completely out of hand. Especially when you're working on an episodic television show. I think that the initial set-ups for all of your objects, hero ships and things like that, need to be made as economical as possible so that when you go to reuse them over and over in every episode, you won't run into big render time problems. If you're loading just tons of megs of images it can really bog down the network which will then slow your rendering down. And if your machine is forced to page all the time, you'll slow things down drastically as well. To me, render times are always an issue whether it be in modeling or texturing. So I always tried to find the most inexpensive ways of doing things without sacrificing the model itself. Believe it or not, a ship like the *Hammerhead* was fairly economical. My friend Richard Payne, who I mentioned was one of the guys who initially trained me in a lot of this stuff, would impress upon me how to model economically, not to waste polygons, not to over model and also how to conserve. Really, how to get the best bang for the buck.

WS: Did you scale down image maps for the low res models?

Denham: Actually, as in the case of the low-res *Hammerheads*, they used the same image maps as the high-res *Hammerheads*. We didn't bother because usually in any shot where there was a low-res *Hammerhead*, there was also a high-res one. So it would be better if they were all sharing the same maps rather than create a whole other set of images for the low res ones. That would actually end up using more memory.

WS: Would you prefer to work with any particular image format over another?

Denham: On **SAAB** we started out by using 256 color IFF images. Then I believe we ended up using a lot of *ham* images because they actually looked a hell of a lot better than the 256 color images and were also a smaller file size.

WS: Knowing that many of the models would have to be composited with live action under various lighting conditions, did surfaces need to be continually tweaked?

Denham: You could make any one any of those models look terrible if you lit it wrong. That's true of any CG model. You could do a beautiful surfacing job and somebody could just light it terribly and make it look like you did a horrible job. We tended to solve our problems using careful lighting as opposed to reworking the

surfaces. So I don't believe we really had to do that at all. The ships held up under most lighting conditions. If you found you were in a situation where you were having trouble integrating one of the models with the live action plate, you just got creative with the lights.

WS: I understand you were also responsible for building most of the *Saratoga*. There seems like an infinite number of details. How did you go about surfacing such an intricate model?

Denham: The *Saratoga* was interesting because the only production art I had for it when we started was literally something like a little ink sketch. I think it was even on a napkin. Basically it looked like a pool table. We really didn't have any production art for it when we started to build. So I just started going off in my own direction and then some production art showed up later. The art was much more specific and we ended up going in that direction. I really didn't design the *Saratoga* but there were some parts I *did* design, like the interior of the bays, the doors on the bottom and how they all worked. Things like that. Those were pretty much put into place before we got the production art so they got included in the art. Ken Stranahan ended up designing and modeling some things on it. An artist named David Jones who actually works with me at *Station X* did a lot of modeling for the top of the *Saratoga*. For the big details, I created quite a number of custom images. The whole underside including the doors were textured in a very specific way. For all the smaller details, I actually did create a generic texture library but I also tried to stay away from doing the usual generic panels. The small details were all pretty dense so I was able to scatter many of those tileable textures around. I think that it worked fine. I wouldn't be surprised if the *Saratoga* had sixty or more custom maps on top of a fair number of tiling images. Generally speaking, anything that I decided on texture wise was always accepted. I never had anybody say this is not how it should look. So I guess I was on the right track.

WS: You must have had an enormous number of surfaces to deal with?

Denham: Oh yeah. The *Saratoga* had something like six hundred or more. But it's like any other model in that once it's surfaced it's surfaced. You kind of hate having that huge list of six hundred surfaces to scroll through but you really don't have to mess with them much after it's done. If there was a specific shot where you needed to change one thing, it could really be a pain to go in and find the surface you needed. I think that it took us a total of about five or six weeks to model and texture it entirely.

WS: Were you responsible for surfacing the planets as well?

Denham: Actually, I had nothing to do with any of the planets. That was all David Jones. He was our planet expert. Before he had come to *Area 51* he was working at *Ambling Imaging* where they had been working on **Star Trek: Voyager** which he actually won an *Emmy* for. He had done planets for them and also had developed his own kind of tool set. He made quite a few that were just beautiful. I think he came in one day and we threw a planet at him and said, "We need a planet." He did one and it looked incredible. So we naturally just said, "Okay, well you get to do our planets." It was one of his specialties and whenever a planet was in a shot it was like, "Dave, make the planet!" He got a little sick of it, I think, but he was really the planet expert.

WS: What other models were you able to build for the show?

Denham: I built the *Tellus* spaceship for the pilot. It was a long, cylindrical ship. The top had a duck-billed shape and there were two booster things on the side. I also designed the moonbase in the episode *Eyes*. We'd gotten some production art for the moonbase and—no offense to the people who did the art—but we just didn't like it. By then we got along great with the producers. They really trusted us so they basically just said "Make it look cool." So I just sat down with some tracing paper and markers and did this really crazy rough sketch of what I thought it should look like. I gave it to Dave Jones who was going to model it and he went ahead and built the thing. Then he lit it and, I think, did all the shots where the moonbase was required. That I was pretty happy with.

Moonbase.

WS: Beyond modeling, you were also assigned many effects shots. Which was the most challenging?

Denham: I usually tried to grab hold of any shot where you saw the bottom of the *Saratoga* with lots of *Hammerheads* flying out, doors opening, that kind of thing. I loved doing the *Saratoga* stuff because I just loved the look of it. It was huge. If you did the shot right it would really come out looking great.

I also ended up being the guy who sort of blew things up. I created a lot of the *Hammerhead* explosion sequences. I would cut them into hundreds of pieces and then hand animate each of them flying away. It's funny, too, because we would take

one of those scenes and we would shrink it down and stretch it. Then we'd use that sequence as a shrapnel fountain. So if we had something else blowing up like a missile hit on the surface of the *Saratoga*, you'd see all this debris spewing up from the explosion. The debris was actually four or five exploding *Hammerheads* but, because they were so distorted, you could never tell. I didn't come up with that trick but it was a good one.

Matt Merkovich was also good at destroying things. He was really an innovator, coming up with effects type animation, like an image sequence that would eat away the surface of something, making it look like the edges were burning. He'd be the guy who would create something like the black hole effect in the episode *Ray Butts* and also that *Hammerhead* that breaks apart in that same sequence. He created the look of the exhaust jets, the machine gun fire and things like that.

WS: When you had to break up a ship, did you feel it necessary to model any interior pieces that you wouldn't otherwise have seen in a typical exterior shot.

Denham: We actually had a bunch of parts that looked like they'd have been inside a *Hammerhead*. We'd also use a couple of shrapnel fountains to fire out debris. Usually most of that was hidden by the blast. By the time the explosion dissipated all you saw was a cloud of stuff. So we didn't need to do incredibly detailed interiors. However, depending on how close the shot was, we'd sometimes create a makeshift framework.

WS: Which of your shots are you especially proud of?

Denham: That's a really good question. I honestly don't know. Many times I would do a shot and not only was I getting to do the animation but I would also be using a model that I built, had helped build or something that I had textured. So even the shots that other people were doing would often involve work that I had done. I guess I felt some ownership in those too.

There were a lot of shots that I did for the pilot that I liked. One in particular was where you were traveling sideways with these *Hammerheads* as they're flying through an asteroid field. One gets hit and goes through this multi-stage explosion. That was one of my favorites just because it was the first thing I ever blew up. I thought it came off really well. In the opening sequence, the teaser from the episode *Hostile Visit*, the *Saratoga* is under attack by the *Chigs*. The alien ships, in silhouette, are dropping bombs and flyng past the explosions. Except for one shot, I believe I did everything else in the teaser. I was basically allowed to construct the entire sequence. I didn't have a lot of storyboards so I interpreted what I had rather loosely. That was probably my favorite.

WS: In 1995, I think many people were surprised to find out that the models on **SAAB** were CG.

Denham: Yes. That was really neat when we started getting e-mail and reading news groups and people were going, "Were those asteroids real rocks or were they...?" That was cool.

WS: You also textured the asteroids, then?

Denham: I modeled and textured them. That was really much more challenging back then than it might seem now. We tried to make a bunch of asteroids and they'd always look really bad. We ended up using brute force modeling on the asteroids themselves. We'd make a lot of pits and craters. I booleaned out the shapes so that it would look like a really jittery object. Then I'd set a smoothing angle so that some of it would be smooth and some of it would maintain the facets from the polygons. We then used a combination of maps that were all different types. I remember I couldn't use the procedural crumple texture because there was something wrong with the way it rendered. It seemed to act like a luminosity map and that was very strange. I ended up creating a tileable crumple. It was interesting. I had to fight with that one for a few days before it all finally came together.

WS: Would you often create your own storyboards in-house?

Denham: There was a storyboard artist who worked for the production. Sometimes we'd get storyboards and sometimes we wouldn't. Often we would get half a storyboard. So we were given a lot of leeway. I think many times if we didn't have a storyboard or we didn't like a storyboard, we would just animate the way we thought it should be. We'd have to pay close attention to what was happening in the shot before and the shot after so that it would cut really well. All of us made sure that we didn't come up with something like a camera move that was too jarring. We'd send it over and if the producers liked it they'd usually edit it into a rough cut and see how it worked. Many times, it got approved. So there were definitely times when we went without storyboards.

WS: How would you describe your time on the series with *Area 51*?

Denham: It was a really good learning experience. The stuff I learned there about just getting work done on a tight schedule and making it look as good as possible has helped me in every place I've been since. I loved working on **Space Above and Beyond**. Working with the producers, Glenn Morgan and James Wong, was fantastic because they let us be really creative. I had a good time working on that show. There was quite a team there. We had a lot of systems in place and no matter what was going on, we were able to churn out an incredible amount of high quality work in a very short time and we always got it out the door. There wasn't a ton of us either so I don't think there would have been many who would have been able to do the amount of work we did and still make it look as good as it did. It was really nice to work with so many talented people.

I wish they were still making **SAAB**. That would have been really nice. I'm very, very proud of that show still. If they ever bring it out on DVD, that'll make me want to go out and buy a player. I just think the show looked great.

WS: Since your time at *Area 51*, you've gone on to work on other ground breaking projects.

Denham: After I left *Area 51*, I went directly to *Digital Domain* where the first thing they threw me on was **Titanic**. So, that was definitely not too bad. I was very happy to have worked on that movie. I think I worked on about fourteen shots including one that was in the simulation sequence. I used a lot of the experience I had gotten blowing up *Hammerheads* to help tear apart the *Titanic*.

Illustrations kindly supplied by the author.