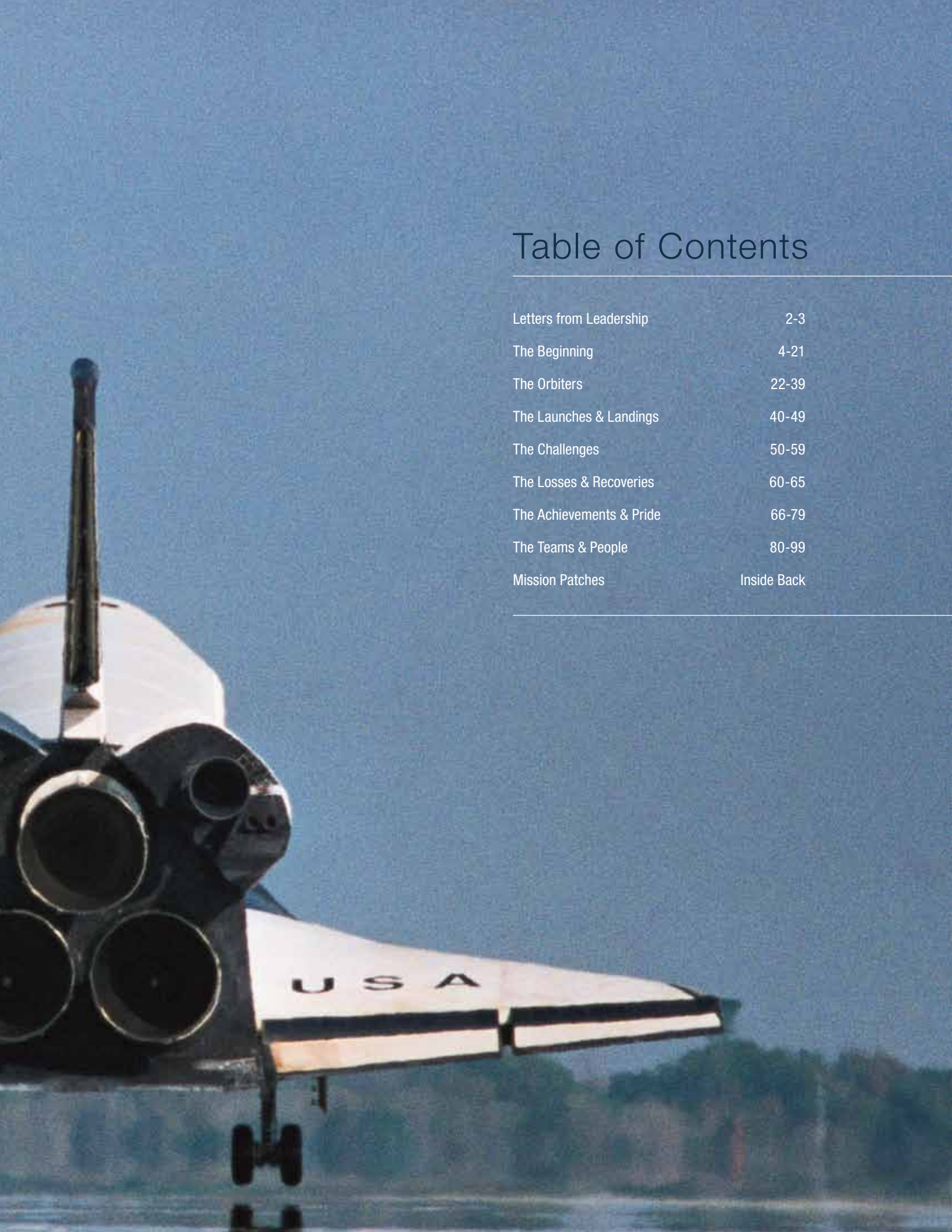
BOEING

Where Memories Soar

The Legacy of the Boeing Space Shuttle Program

Abbreviations & Acronyms

ALT	Approach & Landing Test
APU	Auxiliary Power Unit
CAIB	Columbia Accident Investigation Board
CEIT	Crew Equipment & Interface Test
CFD	Computational Fluid Dynamics
CM	Configuration Management
DCE	Division Chief Engineer
DCR	Design Certification Review
DEI	Design Element Integration
DOLILU	Day Of Launch I-Load Update
DTO	Detailed Test Objective
ECLSS	Environmental Control & Life Support System
ESA	European Space Agency
ET	External Tank
EVA	Extravehicular Activity
FRF	Flight Readiness Firing
FRR	Flight Readiness Review
GN&C	Guidance, Navigation & Control
GPS	Global Positioning System
IUS	Inertial Upper Stage
JSC	Johnson Space Center
KSC	Kennedy Space Center
LCC	Launch Control Center
LH	Liquid Hydrogen
LOX	Liquid Oxygen
MECO	Main Engine Cut Off
MEDS	Multifunction Electronic Display System
MEIT	Multi-Element Integrated Test
MER	Mission Evaluation Room
MLP	Mobile Launch Platform
NBL	Neutral Buoyancy Laboratory
OBSS	Orbiter Boom Sensor System
OMM	Orbiter Maintenance & Modification (aka Major Mod)
OMS	Orbiter Maneuvering System
OPO	Orbiter Project Office
OSP	Operations Support Building
OV	Orbiter Vehicle
PRSD	Power Reactant Storage & Distribution
PTV	Pathfinder Test Vehicle
RCC	Reinforced Carbon-Carbon
RCS	Reaction Control System
RSC	Roscosmos
RTF	Return To Flight
RTLS	Return To Launch Site
SAIL	Shuttle Avionics Integration Laboratory
SCA	Simulation Control Area
SE&I	System Engineering & Integration
SFA	Space Flight Awareness
SMS	Shuttle Mission Simulator
SRB	Solid Rocket Booster
SSME	Space Shuttle Main Engine
SSPF	Space Station Processing Facility
STS	Space Transportation System
TDRS	Tracking & Data Relay Satellite
TPS	Thermal Protection System
VAB	Vehicle Assembly Building
WAD	Work Authorization Document
WLEIDS	Wing Leading Edge Impact Detection System



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Introduction

To all my Boeing Space Shuttle Program teammates —

As the completion of the Space Shuttle Program approaches, Boeing is commemorating more than 30 years of Shuttle operations, as well as our prime contractor role in the design and construction of the Orbiters and analytical integration of the Shuttle stack. Without doubt, the Space Shuttle – through the deployment of a multitude of satellites and star-gazing telescopes and astrophysical instruments, on-orbit support of scientific space laboratories and technological demonstrations, as well as the challenging creation of the International Space Station – has provided immeasurable service to our nation and many other nations of the world.

The Space Shuttle was, and still is, the most revolutionary and innovative crewed space launch system ever created. The success of this historical program was built on the passion and commitment of each person who worked on it. We can all be proud of our respective contributions.

Earlier this year, we encouraged you to share your memories of your experiences on the Shuttle Program. This special commemorative collection honors your hard work, enthusiasm and unfailing dedication to the Orbiters, America's Space Shuttle Program and the larger objectives of our nation's human spaceflight goals.

None of us know for sure what will be the next chapter of our species' exploration of the universe. But, as we turn the page on the Space Shuttle era, we do so knowing there is no better workforce on Earth more capable, qualified or motivated to write it.

Thank you for being part of that workforce.

~ Brewster Shaw, Houston, 33 years with the program

“ Look! Up in the sky! It's

Introduction

Shuttle Team —

With the Space Shuttle Program nearly complete, we'll soon begin to reflect on all of the experiences we've collected over the last thirty years. The tragedies and the triumphs, the friends we've made, the Orbiters we've built. Some of us have spent our entire professional lives in service to these incredible machines that have changed our planet and become cultural icons. More importantly, in doing so, we've become a close-knit family with years and years of meaningful memories.

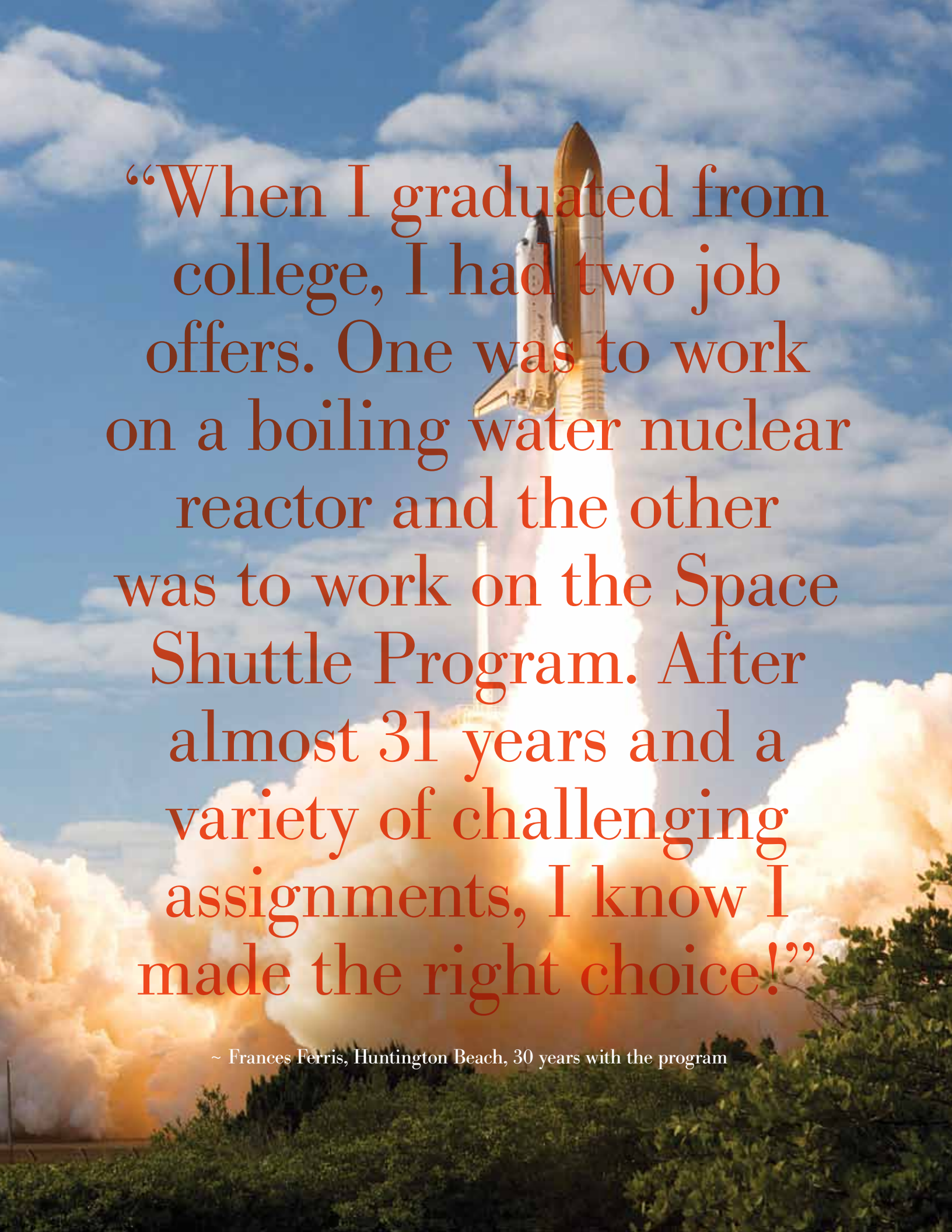
This book is to capture those memories. This is the Shuttle experience as told by us, the people who dreamed it up, built it and operated it from those very first days through the decades that followed. Some of these stories are funny, others are endearing. Some are heartbreaking. But this is a record of what we did by the people who did it. Take time to read each memory. Look at what we've learned, what we remember, what we felt. Look at how we've grown into one of the greatest, most accomplished teams in aerospace history.

I can't tell you the sense of pride I feel when I read through the stories in this book. The sheer magnitude of what this team has accomplished is truly awe-inspiring.

We can all be proud as we share our stories. I know we'll never forget what unbelievable feats of engineering greatness have been accomplished in this program. But let's also never forget this Boeing Shuttle team that helped make it all possible. Thanks to each of you for everything you've done for this program and the Nation.

~ John Mulholland, Houston, 25 years with the program

a bird! It's a plane! It's …"



"When I graduated from college, I had two job offers. One was to work on a boiling water nuclear reactor and the other was to work on the Space Shuttle Program. After almost 31 years and a variety of challenging assignments, I know I made the right choice!"

~ Frances Ferris, Huntington Beach, 30 years with the program

The Beginning

When Apollo XVII splashed down on December 19, 1972, few realized that it would be nine years before there would be another American manned space flight. Those of us who became young adults during the Mercury, Gemini and Apollo years could barely tolerate the idea of standing down an effort that had brought so much honor and achievement to the American space program.

We weren't Boeing then. We were Collins Radio, Rockwell, Rocketdyne, North American Aviation, McDonnell Douglas, and so many legacy companies operating around the edges of the aerospace industry in California, Texas, Florida, Alabama, Mississippi, Ohio, Washington state and in the D.C. area. We were a bunch of starry-eyed dreamers who were convinced that we, as a people and a nation, belonged in space.

But even before Apollo XVII made the final flight of its program, the Space Shuttle was a grand idea taking shape. The contract to build the first Orbiter, Columbia, was awarded five months prior on July 26, 1972. And we began building Columbia in 1975 at Rockwell International's assembly facility in Palmdale, California.

"At Downey, walking in from the Stewart and Gray parking lot through Gate 53, then through the shop on the way up to the engineering offices on the Building 1 mezzanine was hardly exciting. But then one day, a space was cleared on the factory floor and some tooling and fixtures were assembled. Finally, the first Shuttle Orbiter part was clamped into place. Then another. Then a skin panel. Slowly, but surely, a forward fuselage or a reaction control system or an aft fuselage took shape. One day, the shop doors opened and the assembly was trucked off to Palmdale …"

~ Chris Rodgers, Huntington Beach, 38 years with the program

"I would say that the early days of building the Shuttle mockup were the most significant for me. Since it was the real beginning of the Shuttle Program, I remember getting information from an encyclopedia to determine how we would fly the flag on the side of the Shuttle and where we might locate it. I remember that to build the aft floor where the engines would be located, we were using I-frames running fore and aft. To get ideas to simulate them, we headed down Firestone Blvd. to the Home Improvement Center and considered using corrugated fiberglass sheets. But we actually built the I-frame from wood."

~ Larry Blair, Huntington Beach, 30 years with the program

The Beginning

"When I was a senior at UCLA I was invited to attend a career day at the Rockwell plant in Downey. I'm embarrassed to admit this but, despite being a life-long space geek, I didn't know what programs were being done at the plant. As we arrived at the plant and were escorted toward the Design Element Integration (DEI) room, I remember being rather unimpressed with the facility. There were drab windowless buildings as far as the eye could see. I can still hear the distinct sound of the AC units that sounded like the labored breathing of Darth Vader. Just as I was about to give up hope for this trip, we entered the DEI room and I caught my first sight of the Orbiter mock-up. I knew at once that I had found my home …"

~ Stephen Jayne, Houston, 20+ years with the program

"As a wind tunnel test engineer, I had the opportunity to work with many of the Downey-based engineering groups involved in the design and development of the incredible Space Shuttle. I was excited and blessed to work on the largest wind tunnel orbiter model ever made … The model was slightly over one-third scale (43' long with a wing-span of 28') and was designed to be tested in the largest wind tunnel in the country at the NASA Ames Research Center, a 40' by 80' low-speed wind tunnel … upon completion, the huge orbiter model was shipped to NASA Ames in separate components and assembled on site. I was totally awed to see the assembled model lifted by crane, five stories over the huge clamshell doors in the top of the wind tunnel and lowered onto a three-point strut mounting system … Being a part of the most extensive wind tunnel test program ever conducted on an aerospace vehicle has been supremely satisfying and has given me a multitude of memories I will always treasure …"

~ Richard Burrows, Huntington Beach, 39 years with the program

"I began my career in human spaceflight as the slide rule era was ending and before the Orbiter preliminary design review. At that time, the Orbiter still had (on the books) air-breathing engines for trans-continental transport and six payload bay doors. Since them, I've experienced the exhilarating triumphs of the Approach & Landing Test program, the first launch and subsequent development and operational missions as well …"

~ JJ Gallegos, Houston, 37 years with the program

The Beginning

"Let's not forget our rich history. While it's certainly true that Boeing is now the major subcontractor to United Space Alliance, it was the people of Rockwell International who were responsible for designing and building the Space Shuttle in Downey and Palmdale, California. Rockwell was on the $2.6 billion contract in July 1972 to build OV-101 … It wasn't until 1996 that the USA joint venture was formed and the Space Flight Operations Contract was awarded to USA. Rockwell International, now Boeing, employees have been there since the beginning of the program and they are the men and women responsible for this great achievement."

~ Julie Kauffman, Huntington Beach, 22 years with the program

"My memories are about manning the Microwave Scanning Beam Landing System console for the STS-1 launch and also during the Challenger accident, participating in the landing support for STS-3 at White Sands Missile Range and serving on the Shuttle Trans-Atlantic Abort Team."

~ Robert Armstrong, Houston, 32 years with the program

"Space Shuttle design and testing and construction of the Orbiter crew compartments and aft fuselages all happened in Downey in a collection of buildings with a storied past and not enough maintenance … Those of us who lived (worked) there monitored gigantic paint flakes in perpetual imminence of falling off certain walls in Building 1, knew where to put trash cans when it rained, took occasional breaks from work tasks to chase down disruptive crickets and made it a point to look for tell-tale signs of critter traffic in the dust atop cubicle dividers. We laughed and told stories about the decrepitude that surrounded us. Despite all that, there was an aura that magic was happening in Downey …"

~ Anita Gale, Houston, 35 years with the program

The Beginning

"What a privilege to start my career working on the SMS simulator [at JSC] in Building 5 for STS-1 … The pure silence standing in Building 5 during the launch of STS-1. No one said a word, not even a whisper, and the only noise you could hear was the fans running on the Sperry Univac Interdata and IBM computers. Everyone was glued to the TV screens … and 32 years later in my career, I'm still working in the space business."

~ Dale Kohn, Houston, 32 years with the program

"NASA funded and managed the test of the Space Shuttle's digital fly-by-wire system on an F-8 experimental aircraft at Edwards Air Force Base in the early '70s. This was the first time any aircraft in the world had ever been flown without mechanical control. These successful tests not only qualified the Shuttle Flight Control System, but also paved the way for the worldwide use of fly-by-wire technology, which significantly improved performance and reduced costs of both civil and military aircraft …"

~ Peter Kurzhals, Huntington Beach, 36+ years with the program

"I have strong memories of supporting test firings of the Space Shuttle Main Engines (SSME) at NASA's Space Technology Laboratories (NSTL) in Slidell, Mississippi (now known as Stennis Space Center). These tests were conducted from 1978 through 1981 and utilized the Main Propulsion Test Article (MPTA), which comprised all three SSMEs installed in a representative orbiter aft fuselage in combination with an External Tank (ET). There were 12 static test firings originally planned, but due to repeated test issues and hardware failures, they were expanded to 17. It took eight test firings before we achieved one that lasted the full duration of approximately 850 seconds … It was an exciting time for a young loads engineer and I still marvel that, despite the difficult test program before STS-1, we have never experienced an in-flight failure of this remarkably complex main engine."

~ Greg Ray, Houston, 33 years with the program

I remember the first Shuttle rollout. It was overcast, windy and chilly, but there was excitement in the air. And I remember where I was when STS-1 lifted off. I was standing on the outside stairwell at the Launch Control Center."

~ Jerri (Pagano) Arrant, Kennedy Space Center, 32 years with the program

The Beginning

"We used to transport the Orbiters overland out to Edwards. We had a huge transporter that we put the vehicles on to move them down city streets. I can remember prepping the streets prior to Enterprise's first trip down what used to be called Tenth Street (now it's called Challenger Way) in Palmdale. We had to remove stop signs, streetlights, telephone poles, even trees, to make it wide enough to accommodate its wingspan for the 35-mile trip out to Edwards. Thousands of people lined the street and since the public didn't really know what the Space Shuttle was or what it would look like, the oohs and aahs and applause from the crowd brought goose bumps. It was truly amazing …"

~ Robert Kahl, Palmdale, 36 years with the program

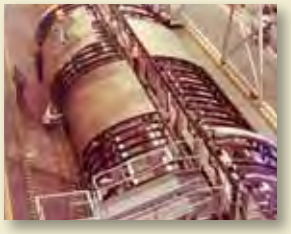
"I remember the first flight test of Enterprise (OV-101) at Edwards … I was standing inside the B-1A test flight facility next to the hangar listening to the security personnel's radios. The test vehicle was dropped from the 747 Shuttle Carrier Aircraft for the first time on August 12, 1977. We heard that separation was successful, but we couldn't see the 747 or the Shuttle in the air above the dry lakebed … Finally we spotted the vehicle and watched it glide to its landing on the dry lake bed. The flight lasted four minutes and the rate of descent still amazes me. A flying brick!"

~ Jeanne Rhodes, Palmdale & Houston, 26 years with the program

"I arrived at Dryden Flight Research Center on January 31, 1977, as Enterprise arrived by road that day. I was handed a radio for my first job, which was to watch the vertical tail of the vehicle and make sure it cleared all hazards. We stopped Enterprise short of entering the Shuttle Hangar door because the tail appeared too close to the opening … I was privileged to witness all five separations of Enterprise from the Shuttle Carrier Aircraft. I plan to make the trip to Florida to witness the last launch of Atlantis and support the final Space Shuttle mission landing. I have really worked the Space Shuttle Program from cradle to grave!"

~ Ignacio Norman, Houston, 34 years with the program

The Beginning



"Shortly before STS-1, I was assigned to perform an independent assessment of the Orbiter Payload Bay Doors. As the largest doors ever to operate in space, they had drawn the attention of NASA and Rockwell management who wanted assurance that they had been designed, manufactured and tested with large margins, and that there was no risk to trouble-free operations that hadn't been eliminated. I spent nearly six months learning every detail of the doors. When my briefing was complete and vetted through Rockwell management, I was told to be ready for a meeting with NASA. To my surprise, 'NASA' turned out to be Commander John Young and Pilot Robert Crippen, the STS-1 crew, who flew from Houston to Downey to listen to the results of my work. To this day I treasure the original copy of the briefing and the STS-1 poster they signed at the end of our meeting."

~ Dwight Woolhouse, Huntington Beach, 39 years with the program

"It's hard to sum up a career spent mostly on one program, and one as significant as the Space Shuttle. I can remember my first interview with Mike Hlavin and Tom Balla, when I talked about wanting to do simulation work and not really understanding what that meant. But I sure learned, especially with all the simulations we did in the SAIL and our own Building 4 labs. And all the full-up flight simulations we did to prepare for those early flights! ... And I can recall being a newbie, working on the Flight Software documentation, getting all aspects of the flight supported through the on-board computers documented and under configuration control, and working with the subsystem guys to define what their hardware needed in order to communicate with the rest of the vehicle … I recall the thrill of the ALT program and watching the piggyback flights and the drop-test flights out at Edwards … But nothing compares to the first flight … with a three-day delay for a computer glitch and then a spectacular liftoff, viewed from the Mission Evaluation Room in Houston … The program was exciting and compelling for its time. There were lots of days of drudgery, but to look back now on such a feat as this, I can only recall the wonderful people, the excitement and struggle to prepare for every launch, the tragedies of Challenger and Columbia and the tenacity of everyone to fly again! To all who saw the program through to its retirement, I salute you all for a job very well done!"

~ Millie Kronfly, Downey & Huntington Beach, 27 years with the program

The Beginning

"My first assignment after college was with McDonnell Douglas as a propulsion test engineer on a very hands-on program at White Sands Test Facility. At my first test firing of the reaction control engines, I was too excited to notice that all my colleagues had taken a couple of steps back. Even though we were hundreds of yards away, when the first engine fired, the sound and the pressure wave was unbelievable (and unexpected) causing me to almost jump out of my shoes … Then I heard the laughter of my colleagues who enjoyed my reaction more than the engine firings …"

~ Joseph Morano, Seal Beach, 6 years with the program (1978-1984)

"I worked on the development of the Abort Region Determinator (ARD) that took several man-years of effort, followed by years of simulations and tests to make sure it had enough shelf-life to support STS-1. During the launch, I invited a friend to go onsite at JSC with me to check things out at Building 2 where all the broadcast networks had their news desks set up. I got a surprise and a good chuckle out of seeing that the German TV news desk was labeled AARD-TV, and I was gratified, but not surprised, that the vehicle and our software worked pretty much as designed."

~ Mike Fisher, Houston, 35 years with the program

"I really enjoyed the days in Downey where we assembled the crew module and aft fuselages for the vehicles. Seeing them built piece by piece and witnessing the first launch of STS-1 of OV-102 was very memorable."

~ Kenneth Duong, Huntington Beach, 32 years with the program

"My significant memories are working on the original Phase A Study, Phase B Design Study and the C/D Production proposals … But the thing that really hit home with me was STS-1. I am not an emotional person, but that launch got to me when I thought of all we had gone through to get to that moment …"

~ Ron Miller, Huntington Beach, 42 years with the program

The Beginning

"I remember the early morning hours of Columbia's maiden voyage. We gathered at the home of one of the engineers. Half of my department was sitting in his living room on pins and needles in anticipation of the launch. Many of these folks had worked on the program since its inception. As the countdown reached 3, 2, 1 … we all held our breath and watched in awe and great relief as Columbia lifted off the pad … all the smoke and fire … it was breathtaking!"

~ Karen Cabanillas, El Segundo & Seal Beach, 31 years with the program

"With more than 32 years in the Shuttle Program, I have so many fantastic memories, each unique in their own way. A few that stand out are: the initial arrival at KSC of Columbia aboard its 747 Shuttle Carrier Aircraft, flying no more than 100 feet over our heads at the Shuttle Landing Facility; and the very first fuel servicing where I had the opportunity to stand alone on the MLP at Pad A with Columbia at night under the lights, while we worked to raise hypergolic fuel loading carts for the first time … the STS-1 processing and firing room assignments and the 'I can't believe we're really going to do it' first launch … the four initial Shuttle development flights including getting up close and personal with President Reagan at Edwards on July 4, 1982 where we had just landed Columbia (STS-4)."

~ John (Ken) Smith, Kennedy Space Center, 32 years with the program

"One of my most significant memories is the launch of STS-1. The two or so years leading up to that milestone was an experience I, nor anyone else who worked them, will ever forget … Working with the BEST launch team in the world has truly been an honor …"

~ Daniel Lacey, Kennedy Space Center, 33 years with the program

"My most significant memory is of the first flight of Columbia. I was working from the Engineering Support Area at Firing Room 2. Seeing the vehicle go past the window was the culmination of a years-long team effort … and I will never forget the ambiance at KSC in the days before the flight, especially on the eve of the flight driving into KSC. Seeing the white vehicle illuminated against the dark sky was a quasi-religious experience."

~ Gustavo Avila, Huntington Beach, 30 years with the program

The Beginning

"I remember the hectic days leading up to the first Shuttle launch. The Orbiter was transferred from Palmdale to KSC with a large amount of unfinished work on the Manufacturing Orders … so a large group of Palmdale manufacturing people came along with the work. We worked long hours in pre-processing for the first launch while the Palmdale people completed their manufacturing work. I remember working through the early morning hours to install our antenna couplers in preparation for the Orbiter Radiation Frequency system tests the next day … and going home satisfied that we were ready to start our Communication and Tracking system checkout … only to find the next day that the Palmdale tile folks had removed many of the couplers so they could access the tiles beneath them … Just one of the many challenges we faced trying to perform manufacturing and operations at the same time … but we got through it and the rest is history …"

~ Norman Buchert, Kennedy Space Center, 39 years with the program

"I remember working as a Brevard County Lifeguard at Jetty Park for STS-1. We spent the night in the lifeguard station so that we could park cars early the next morning and then man the lifeguard stands on the beach for that first launch. The jetties were packed full of people and we had to deal with cuts and scrapes when people slipped trying to gain a better vantage point … our view from the lifeguard stand was pretty good, though."

~ Chris Leonard, Kennedy Space Center, 30 years with the program

"We were providing 24-hour support and I had the shift the night before the launch of STS-1. It was a beautiful day for a morning launch. We climbed up on the MLP parked in front of the VAB so we could get a better view. When STS-1 lifted off, I remember feeling the waves of sound from the launch rocking me backward, and then as the sound bounced off the VAB, it rocked me forward and continued for several seconds … We were laughing and crying and praying that it would keep going …"

~ Richard Bard, Kennedy Space Center, 30 years with the program

"I hired on at Downey in April 1981 and I've been involved with the Shuttle off and on ever since. The events that are the most memorable to me are: the STS-5 landing in November 1982 and supporting a launch (STS-33) in November 1989; getting to climb around inside Columbia to help visualize Shuttle upgrade concepts for several advanced design studies; seeing my airlock water/oxygen lines being installed on Discovery for the new docking module; and taking my son's Cub Scout den for tours of the full-size Shuttle mock-up in Downey's DEI room. My career has coincided with the Shuttle's career. I'm going to miss my traveling companion."

~ Chava Gerber, El Segundo, 30 years with the program

The Beginning

"I think my most memorable experience was watching STS-1 lift off the pad and witnessing, firsthand, the fruits of everyone's labors in preparing for this very significant event in manned spaceflight. I've thoroughly enjoyed my career on the Shuttle Program."

~ George Ogle, Kennedy Space Center (NSLD), 35 years with the program

"For STS-1, I was performing near real-time analysis of inertial measurement unit performance during ascent. I had just completed submitting my card deck (remember those?) to the IBM 360 in Building 12. As I was leaving, I met Gene Kranz coming out of Building 30 and we exchanged a big 'thumbs up' for having a successful launch."

~ Michael Rasmussen, Houston, 30 years with the program

"My first job on the Shuttle Program was as a Communications and Tracking engineer with Rockwell starting in the summer of 1982. My first task was testing the S-Band system on the new Orbiter OV-099 – Challenger. During my early years here at KSC, I was greatly influenced by the senior engineers, many with Apollo legacy, who mentored me and helped me through my first years on the job. I enjoyed learning about the Orbiter systems and working as a team to solve the problems we encountered. The days were long, but rewarding …"

~ William (Bill) Perkins, Kennedy Space Center, 29 years with the program

"I remember the early days of the Space Shuttle at KSC before the first launch. Everyone was in awe of what we were doing … Everyone was dedicated to doing their best to help the Space Shuttle succeed. People from multiple companies and government agencies willingly worked together to solve problems in an incredibly positive work environment to accomplish something truly significant. Those were certainly the best of the good old days …"

~ Richard (Rick) Proctor, Everett, WA, 33 years with the program

The Beginning

"I was in the Downey DEI room to view the STS-1 launch. The big screen in front of me, the Orbiter mock-up to my left, one of the Apollo command modules to my right … and this huge mural of Rockwell space products painted on the North wall. As we witnessed the launch … there was this amazing feeling in the room … excitement and an awesome feeling of team accomplishment as the Orbiter got into orbit … mixed with an aura of this incredible space legacy we were trying to live up to … and a heightened level of anxiety knowing that we had to re-use the Orbiter for STS-2."

~ John Nakamoto, Anaheim, 8 years with the program

"I was a member of the Launch Support Team sent to KSC to assist the Rockwell Launch Team with the Orbital Flight Test Program. I thought it would be smooth sailing after the successful STS-1 mission and I was on hand to monitor the pre-launch data for STS-2. Little did I know that questionable data in my subsystem, the Auxiliary Power Unit (APU) subsystem, would cause a 10-day launch delay. It was the worst experience of my life! But we worked the problem and STS-2 finally lifted off."

~ Stan Barauskas, Huntington Beach, 38 years with the program

"Probably the most significant memory I have from the Shuttle Program is remembering John Young's reaction during his post-flight walk-around of Columbia while she was still sitting on the Edwards lake bed immediately following the landing of the first mission, STS-1. His joy in the performance of the Orbiter could only have been more apparent if he had skipped around the vehicle or done back-flips down the runway centerline … He just had this HUGE grin on his face and an obvious bounce to his walk … all in celebration of the successful first flight of a re-usable spacecraft!"

~ Gerald (Jerry) Sheehan, Kennedy Space Center, 39 years with the program

The Beginning

"There have been many fond memories over the years, starting with the first arrival of Columbia at KSC. It looked a bit rough with its missing tiles, but I felt it was the most beautiful thing I had ever seen … I remember the great sense of team pride evident with every first milestone accomplished on the way to STS-1 … and of course, the STS-1 launch … as the countdown progressed, the excitement in the air was electric, mixed with a quiet nervousness as the Shuttle prepared to venture into the unknown … then the excitement was undiminished all the way through to landing … It was like being on the team that had won the biggest game ever!"

~ Patricia Ruddell, Kennedy Space Center, 35 years with the program

"My first memory of Shuttle was the STS-1 landing at Dryden Flight Research Center where I was a Presidential Management Intern and NASA Contracts Specialist (I had the privilege of writing my first contract for the hazardous fuel disposal for STS-1) … On a bright sunny day over the Antelope Valley, the twin sonic booms of the Columbia's approach signaled the beginning of an amazing era … Spotting Columbia as a tiny dot as she began her turn over the Air Force Rocket Lab was thrilling … As she rolled to a stop, the crowd could not stop cheering …"

~Ann Halligan, Houston, 30 years with the program

"I started working for Collins Radio, which became Rockwell International, 36 years ago in Newport Beach … I was officially certified to solder circuit boards and connectors for the Space Shuttle Program … I also learned to wire harnesses and assemble modems and became an electro-mechanic assembler. Now, years later, I maintain the Shuttle documents and to me, it's like running a small library that I dearly love!"

~ Arlene Moreno, Huntington Beach, 37 years with the program

"I'll never forget my first day at Rockwell. I had just moved a thousand miles and didn't know anyone, but one of the guys in my group took me to the full-scale mock-up of the Orbiter. We went up and sat in the Pilot and Commander seats. It was so cool to think this is what the Shuttle is really like …"

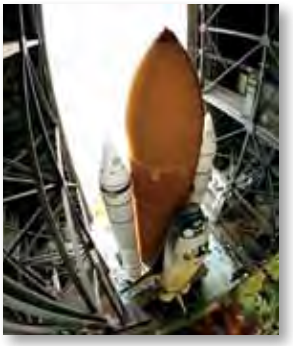
~ Chuck Meis, Seattle, 30 years with the program

The Beginning

"A very memorable experience was some time after STS-1 when President Reagan visited the North American Rockwell facility in Downey – a historic site with roots that date back to WWII and the birthplace for the Apollo capsules as well as the Space Shuttle … I still have the small American flag I was handed for the event that was held in the middle of the manufacturing area. The President's visit and speech was a poignant reminder to all of us of the significance of the Space Shuttle Program to our country's human spaceflight aspirations and the world community …"

~ Rafael Gatica, Houston, 30 years with the program

"One memory that stands out is supporting the landing of STS-4 at Edwards on July 4, 1982. President Reagan gave a speech with Enterprise, with a giant American flag draped over her right wing, positioned immediately behind the podium. Exactly as his speech ended, the 747 Shuttle Carrier Aircraft with the newly built Orbiter Challenger, took off and headed for KSC. Those were the days!"



~ Ken Webb, Kennedy Space Center, 30 years with the program

"I've worked on the Space Shuttle for more than 24 years. The first two years or so were spent working on a drafting board. When the vehicles were in Palmdale for Orbiter Maintenance and Modification (OMM), that's when things got exciting for me. We would go to Palmdale for extended lengths of time as on-site engineers to resolve issues and problems as they arose. I felt privileged to be one of a few people allowed access to the vehicles. To actually touch, climb into, walk on and crawl around a ship that had been in space was, to me, out of this world."

~ Eugene Gonzales, Huntington Beach, 24 years with the program

"When I hired on at Downey as a young inexperienced engineer back in the 1980s, I was confronted with an immense group of genius designers. What I saw my first day was a sea of drafting boards and people laboring over them. What a sight to behold! The Space Shuttle being designed right in front of my eyes! I jumped right in and never looked back."

~ Paul Sorokin, Kennedy Space Center, 31 years with the program

The Beginning

"When I started flight support in the MER, all thermal engineers were seated in a small backroom behind the MER Managers, using the only computers available – the Trend Monitoring System. These huge desk-sized computers could perform only one function, which was plotting flight data. Actually, I think my cell phone has more computing power than they did. Everything else that engineers did was done on a slide rule or simple calculator or drawn by hand! The Space Shuttle was designed, built and operated with these simple tools."

~ Bill Andrews, Houston, 30 years with the program

"Fresh out of college, I happily joined the Space Shuttle Program at Downey in 1983. I felt like the luckiest guy on Earth … I was working on the greatest space transportation system in the world! As the new guy, I was volunteered to learn Computer-Aided Design (CAD). This was not considered an honor in our group, merely a way to meet a requirement for training on this new tool that many engineers felt was nothing more than a fad. Well, it turned out that CAD proved itself to be a very useful tool. Drafting boards and machines soon became things of the past … 28 years later, I still feel lucky. These great vehicles are being retired, but the accomplishments will never be forgotten and the groundwork has been laid for an exciting future in space. It has been a great privilege to participate in such a unique and worthy program."

~ David Thompson, Houston, 28 years with the program

"I've had many memorable experiences. In 1984, just out of college, sitting excitedly in an interview trying to figure out in my head where the heck the Orbital Maneuvering/ Reaction Control Subsystems were on the ship … and what the heck hypergolic propellant was, all while trying to look like I knew what the Engineering Manager was talking about … I remember inadvertently clearing the Orbiter Processing Facility (OPF) High Bays on three separate occasions because of hypergolic propellant spills … and on the first one, having the senior engineer run into the Firing Room to tell me that if anyone asked, to tell them I was 'stand boarded' … and thinking 'what the heck does that mean?'"

~Ronald Rehagen, Kennedy Space Center, 26 years with the program

"I've witnessed two night launches, but the STS-1 landing is my favorite memory. I was with my Dad at Edwards, in the desert on the edge of the large dry lakebed. It was April 14, 1981, but it seemed like the Fourth of July. Music was blaring. American flags were waving. There were many large RVs, beach chairs and umbrellas and more than 200,000 people. It seemed like a great big beach party without the ocean … Later on, I remember that the two Astronauts from STS-1 came to visit Downey where I worked. They walked down a red carpet between the helicopter pad and the stage outside our main building. It was a beautiful sunny afternoon and we shook their hands as they passed by. It was inspiring and I was lucky enough to be able to work on the Shuttle Landing Systems for the next three decades!"

~Michael Porter, Huntington Beach, 32 years with the program

"The most memorable and fun time during my 31 years in the Shuttle Program has to be getting this complex machine to fly. While the Orbiter definitely looked cool, the assembled integrated stack was unlike anything I had ever seen. Like the Great Pyramids of Giza in Egypt, it will be in history books for generations to come. We did something that would be viewed by future generations as a dream come alive."

~ Essam Ismail, Kennedy Space Center, 31 years with the program

The Orbiters

Although the public saw the Orbiter's familiar shape and thought "aircraft," we knew the Space Shuttles for what they really were — spacecraft. The most sophisticated spacecraft conceived, designed, built and operated ever. Record-breaking, history-making human spaceflight vehicles made of 2.5 million different parts, assembled meticulously by hand, and processed and prepared just as meticulously after every mission.

Where the public came to take the Shuttles for granted and viewed their operation as routine, we never did. We understood how long it took to build them. We knew how complicated they were. We lived with them as they took shape in Downey and Palmdale. We waved as they flew away to Florida on the back of the Shuttle Carrier Aircraft to their dates with the launch teams at Kennedy Space Center. We welcomed them back when they landed, wherever they landed. And we embraced them when they came home for OMM.

These spacecraft belong to us. We created them. We cared for them. To us, they were (and are) living entities — each with a character, unique features and personality quirks. They are indeed, cherished and revered members of our extended space-faring family.

"During my career, it has been my pleasure to meet and work with one of the most intelligent and dedicated workforces in this country. I will always marvel at the sheer enormity of the Shuttle Program, the ingenuity and dedication required to create a space ship that has truly been the next step in the evolution of space travel. Following the accomplishments of the Apollo Moon Mission Program, the Space Shuttle Program moved from the drawing board to the metal shop to the manufacturing floor to the launch site. It has been my privilege to help build, ferry, launch, land and maintain all five Orbiters – working from such places as Palmdale and Edwards AFB to White Sands, from KSC to JSC as well as component vendor locations across the country. We at KSC have had the distinct honor of working on and protecting one of the greatest endeavors this country has ever pursued …"

~Danny Fitzgerald, Kennedy Space Center, 31+ years with the program

"I was in awe of this engineering marvel …"

"The fourth landing of Columbia is the historical equivalent of the driving of the golden spike, which completed the first transcontinental railroad. It marks our entrance into a new era."

~ President Ronald Reagan, on the final test flight of the Space Shuttle, STS-4, 4 July 1982

Getty Images

Columbia (OV-102)

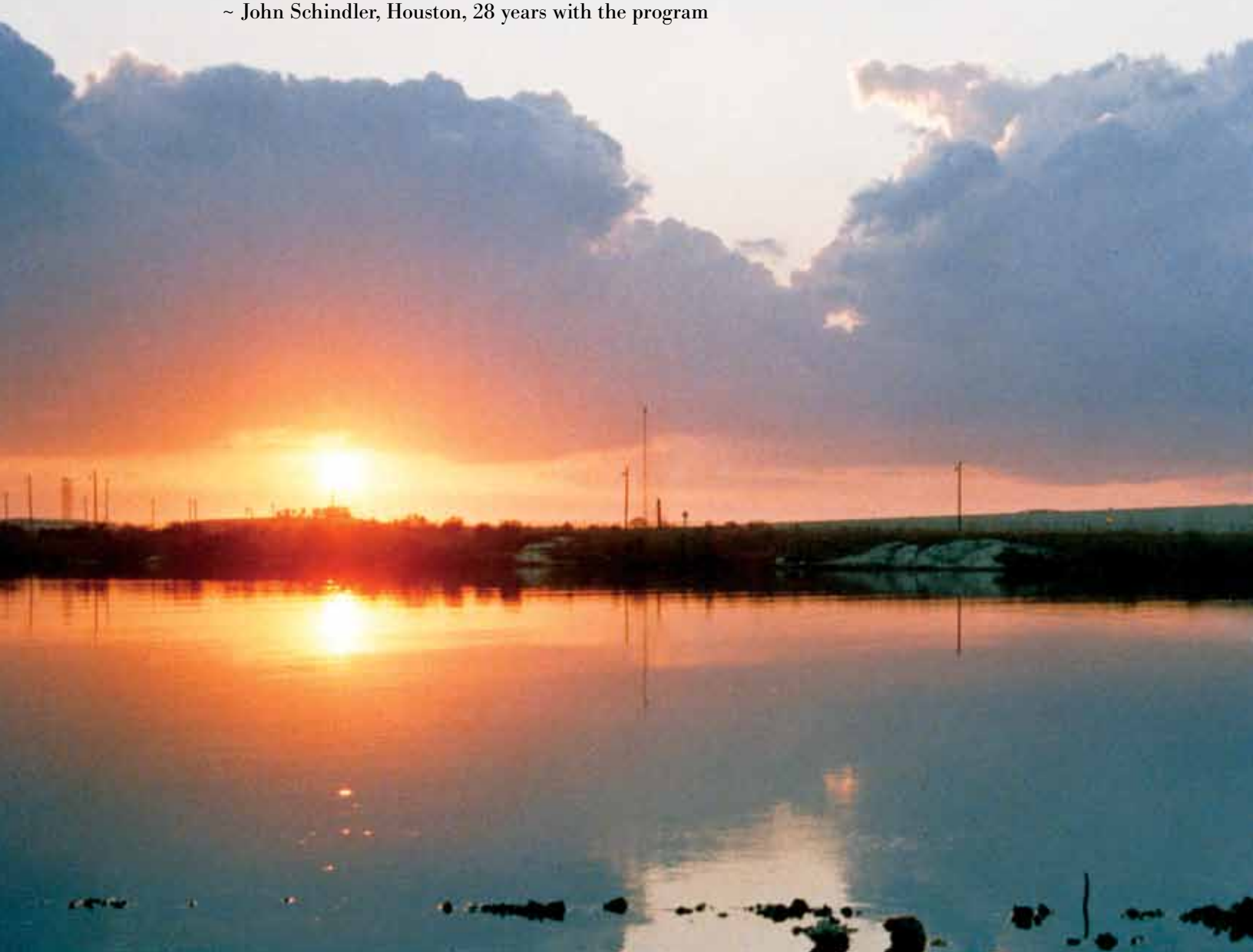
"You never get tired of seeing a launch, participating in a mission and being involved everyday with preparing the Orbiters for the next mission."

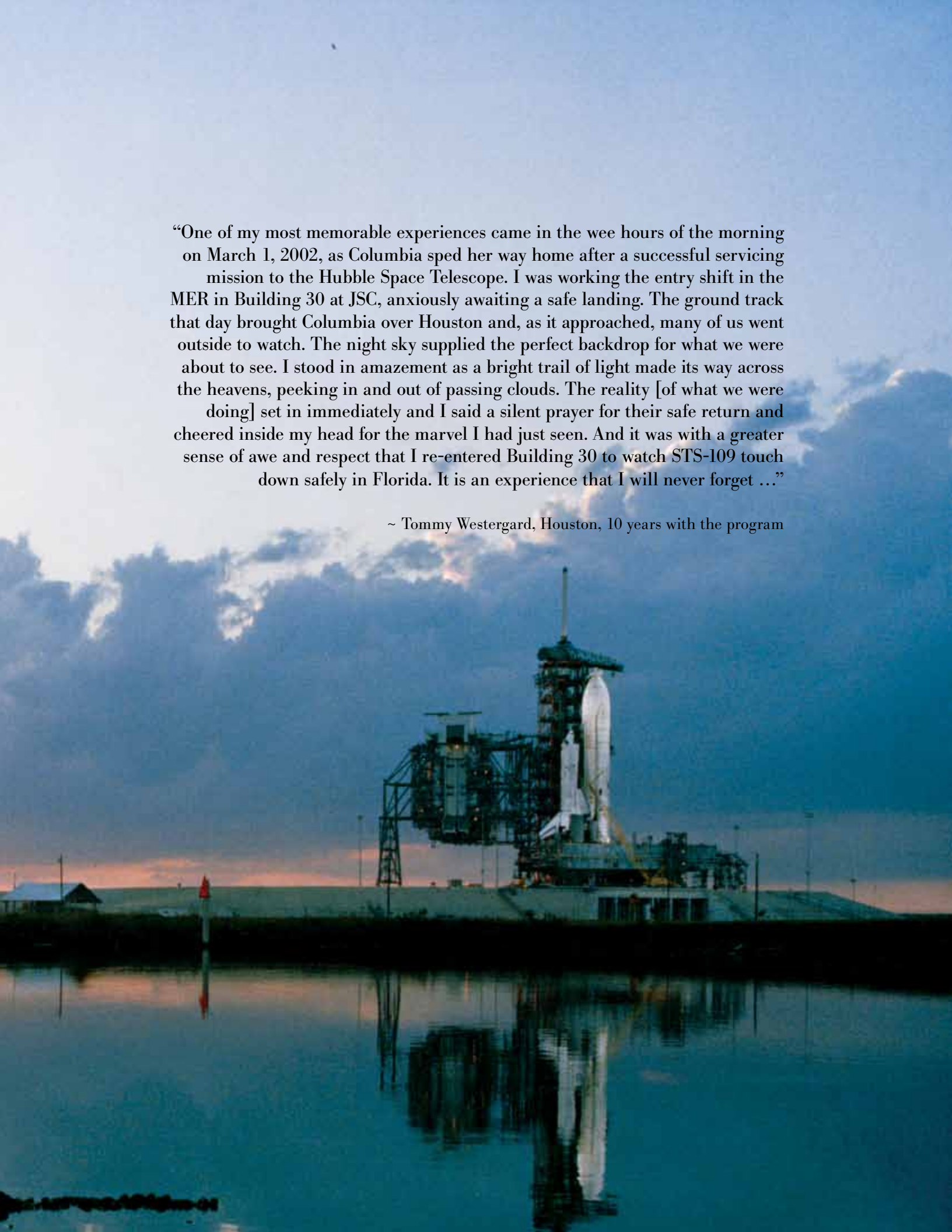
~ John Schindler, Houston, 28 years with the program

Contract Award:	July 26, 1972
First Flight:	STS-1 April 12, 1981 – April 14, 1981
Last Flight:	STS-107 January 16, 2003 – February 1, 2003
Missions:	28
Time in Space:	300 days, 17 hours, 40 minutes
Orbits:	4,808
Distance Travelled:	25,204,911 miles
Satellites Deployed:	8
Named After:	Columbia Rediviva, the Boston-based sloop captained by Robert Gray who explored the Pacific Northwest in the 1790s. Also named after the Command Module of Apollo 11, the first manned spacecraft to land on a celestial body.

"I can vividly remember my first interview to work on the Space Shuttle with Rockwell International. It took place at the KSC launch complex in the VAB with various engineering managers. Later that same week, I witnessed my first Space Shuttle launch, STS-4. Needless to say, I could hardly wait to tear open the job offer I received from Rockwell and it just kept getting better after that … On my first day of work, my lead took me over to the OPF and we took a tour of Columbia. We walked inside the payload bay, crawled into the aft compartment and spent time in the crew module. I was in awe of this engineering marvel, which I had just seen launched a few months before and was humbled and honored to be part of the Space Shuttle team … I've been lucky to have worked with so many outstanding people and to have been a part of such a successful program."

~ John Schindler, Houston, 28 years with the program





"One of my most memorable experiences came in the wee hours of the morning on March 1, 2002, as Columbia sped her way home after a successful servicing mission to the Hubble Space Telescope. I was working the entry shift in the MER in Building 30 at JSC, anxiously awaiting a safe landing. The ground track that day brought Columbia over Houston and, as it approached, many of us went outside to watch. The night sky supplied the perfect backdrop for what we were about to see. I stood in amazement as a bright trail of light made its way across the heavens, peeking in and out of passing clouds. The reality [of what we were doing] set in immediately and I said a silent prayer for their safe return and cheered inside my head for the marvel I had just seen. And it was with a greater sense of awe and respect that I re-entered Building 30 to watch STS-109 touch down safely in Florida. It is an experience that I will never forget …"

~ Tommy Westergard, Houston, 10 years with the program

"Our nation is indeed fortunate that we can still draw on an immense reservoir of courage, character, and fortitude, that we are still blessed with heroes like those of the Space Shuttle Challenger. Man will continue his conquest of space, to reach out for new goals and ever-greater achievements, that is the way we shall commemorate our seven Challenger heroes."

~ President Ronald Reagan

Getty Images

Challenger (OV-099)

Contract Award:	January 1, 1979
First Flight:	STS-6 April 4, 1983 – April 9, 1983
Last Flight:	STS-51L January 28, 1986
Missions:	10
Time in Space:	62 days, 7 hours, 56 minutes
Orbits:	995
Distance Travelled:	25,803,939 miles
Satellites Deployed:	10
Named After:	HMS Challenger, a British corvette was the command ship for the Challenger Expedition, a global marine research expedition that was conducted from 1872 through 1876. Also named for the Apollo 17 lunar module Challenger, which landed on the moon in 1972.

“She’s been an amazing machine; she’s done everything we’ve asked of her.”

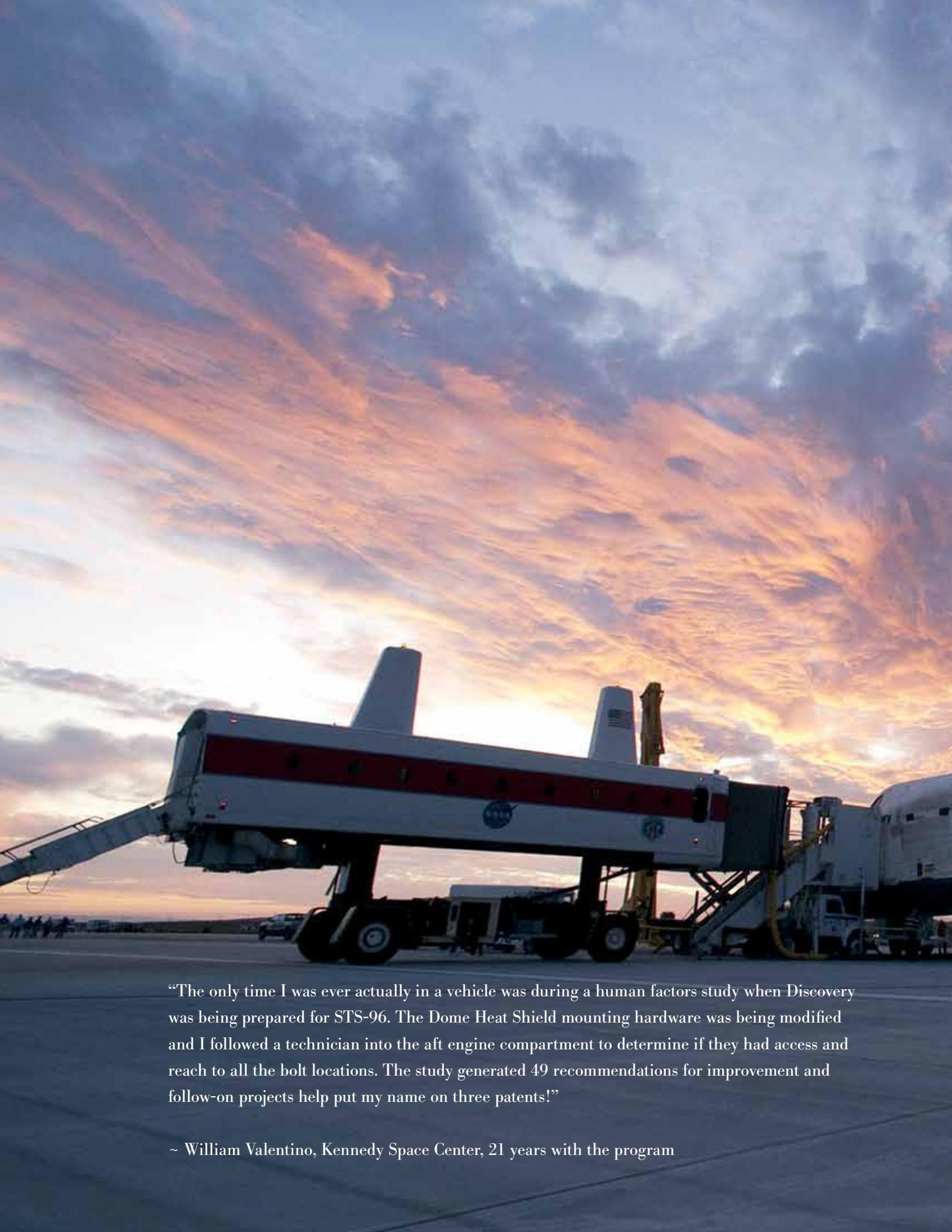
~ Mike Leinbach, NASA Shuttle Launch Director, Kennedy Space Center

Discovery (OV-103)

"In 1984, when I started working on the program, I watched the maiden launch of the Space Shuttle Discovery. After 39 flights in 2011, I watched the final flight of Discovery. It was a nostalgic moment to see Discovery touch down."

~ Sharon Stacy, Huntington Beach, 26 years with the program

Contract Award:	January 29, 1979
First Flight:	STS-41D August 30, 1984 – September 5, 1984
Last Flight:	STS-133 February 24, 2011 – March 9, 2011
Missions:	39
Time in Space:	365 days, 12 hours, 53 minutes
Orbits:	5,830
Distance Travelled:	148,221,675
Satellites Deployed:	31
Dockings:	Mir – 1 ISS – 13
Named After:	HMS Discovery, one of the ships commanded by Captain James Cook during his third and final major voyage from 1776 to 1779. Also named for three other British ships of exploration named Discovery: Henry Hudson's search for the Northwest Passage (1610-1611); Captain George Nares' British Arctic Expedition to the North Pole (1875-1876); and the Royal Geographical Society research vessel under the command of Captain Scott and Ernest Shackleton in the "Discovery Expedition" to Antarctica (1901-1904).



"The only time I was ever actually in a vehicle was during a human factors study when Discovery was being prepared for STS-96. The Dome Heat Shield mounting hardware was being modified and I followed a technician into the aft engine compartment to determine if they had access and reach to all the bolt locations. The study generated 49 recommendations for improvement and follow-on projects help put my name on three patents!"

~ William Valentino, Kennedy Space Center, 21 years with the program

"On my first day on the job, I was given a walk-down tour of the OPF-3 where Discovery was housed. It was my first chance to get close to a real spaceship and actually touch it. It was the fulfillment of a life-long dream to be part of the manned space program. Over the course of the remaining years of the program, I had many chances to go into every part of the Orbiter and see these amazing spaceships. I even got to sit in the commander's seat while Discovery was vertical on the MLP. These were all great experiences and will never be forgotten, but the first day will remain the best memory of all."

~ Mark Mansfield, Kennedy Space Center, 7 years with the program

"... and liftoff of Space Shuttle Atlantis, the final visit to enhance the vision of Hubble into the deepest grandeur of our universe."

~ NASA launch commentator

Getty Images

Atlantis (OV-104)

"My most memorable launch was the launch of Atlantis, STS-110, on April 8, 2002. Atlantis had new engines. I walked outside the OSB at KSC and stood with my co-workers. As it launched, our Orbiter Director said, 'Listen to those engines roar.' The wind had been just right and it was the loudest and most amazing launch. But my proudest launch memory and the most special of all was sharing my Space Flight Awareness launch honoree award with my son, Ethan, for the STS-131 mission of Atlantis in April 2010. We watched it all from the Saturn V facility and it was perfect."

~ Leigh Craig, Kennedy Space Center, 11 years with the program

Contract Award:	January 29, 1979
First Flight:	STS-51J October 3 – 7, 1985
Last Flight:	STS-135 July 2011
Missions:	32
Time in Space:	293 days, 18 hours, 29 minutes
Orbits:	4,648
Distance Travelled:	120,650,907 miles
Satellites Deployed:	14
Dockings:	Mir – 7
	ISS – 11
Named After:	RV Atlantis, a two-masted sailing ship that operated as the primary research vessel for the Woods Hole Oceanographic Institution from 1930 to 1966.

"We're going to take Endeavour out for a couple more, probably about 5 or 6 million more miles … After 25 flights, we will hopefully land here on this runway and then Endeavour is done with its service to the country."

~ Commander Mark Kelly, STS-134

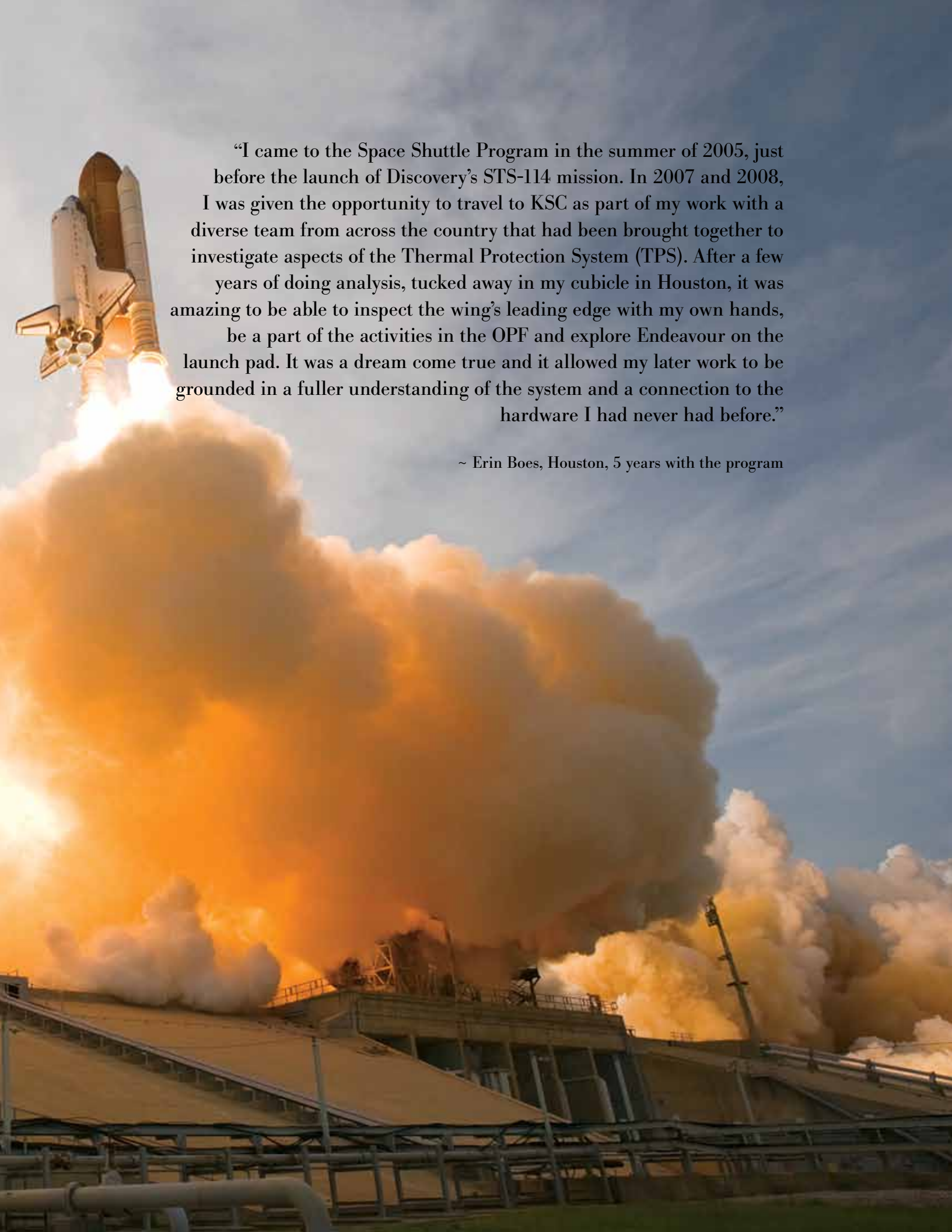
Getty Images

Endeavour (OV-105)

Contract Award:	July 31, 1987
First Flight:	STS-49 May 7, 1992 – May 16, 1992
Last Flight	STS-134 May 16, 2011 – June 1, 2011
Missions:	25
Time in Space:	280 days, 9 hours, 39 minutes
Orbits:	4,429
Distance Travelled:	103,149,636 miles
Satellites Deployed:	3
Dockings:	Mir – 1 ISS – 10
Named After:	HMS Endeavour, Captain James Cook's ship on his first voyage of discovery (1768-1771).

"My most significant memory is when I took the helm of the Displays and Controls Subsystem manager position for Boeing and sat, for the first time, on-console at the Launch Control Center to support Space Shuttle Endeavour on STS-113. I was able to walk downstairs and watch the liftoff from ground view. It became an instant classic in my heart. It was an unreal moment. My emotions were running high in the anticipation of the greatest show on Earth just over three miles away … It was still dark just before 8AM when Endeavour launched and lit up the sky with its glow. The earth-shattering sound just ate up my body and I felt one with the machine …"

~Jimmy Cornejo, Everett, WA, 14 years with the program



"I came to the Space Shuttle Program in the summer of 2005, just before the launch of Discovery's STS-114 mission. In 2007 and 2008, I was given the opportunity to travel to KSC as part of my work with a diverse team from across the country that had been brought together to investigate aspects of the Thermal Protection System (TPS). After a few years of doing analysis, tucked away in my cubicle in Houston, it was amazing to be able to inspect the wing's leading edge with my own hands, be a part of the activities in the OPF and explore Endeavour on the launch pad. It was a dream come true and it allowed my later work to be grounded in a fuller understanding of the system and a connection to the hardware I had never had before."

~ Erin Boes, Houston, 5 years with the program

"Experiencing my first launch and landing, climbing in the nozzle of an SSME at Dryden and working with wonderful people … those are my most significant memories."

~ Eddie Zanner, Everett, WA, 23 years with the program

The Launches & Landings

Smoke and fire. Flying and landing a brick. These are not the descriptions one would normally associate with take-offs and landings of conventional aircraft.

The level of scrutiny paid to every Space Shuttle system and subsystem, as well as every system and subsystem in ground, launch and landing operations at Kennedy Space Center, or in landing operations at Edwards or White Sands, is incomprehensible to those whose only experience of launches and landings are what they see in the media or from the viewing stands and the causeway at the Cape. The general public only began to understand the dangers of ascent and descent in the aftermath of the Challenger and Columbia accidents.

But we know better. We've always understood the mind-boggling complexity of the machine and the fragile balance between structural integrity, technical performance and human capability.

We understand that the countdown actually begins two days prior to launch. We know that, more often than not, launches slip because of adverse weather conditions at the Cape, or across the pond in Spain or North Africa, not because there's a problem with the vehicle or the stack at the pad. We know that the propulsive power expended by the SSMEs in the first eight minutes after lift-off is equal to the output of 23 Hoover Dams. And we understand that there's nothing easy or simple or routine about accelerating from zero to 17,500 mph in eight minutes (to main engine cut-off).

And we understand that descent and landing is actually an unpowered fall from low Earth orbit to terra firma. The Orbiter vehicle glides to its landing, its HRSI-tiled underbelly, its reinforced carbon-carbon wing leading edges and its nose glowing from the friction of re-entering the Earth's atmosphere from the vacuum of space. We understand that it's not just a matter of pushing on the brakes to slow the Orbiter's airspeed from above Mach 18 to a manageable 215 mph at touch down in 15-16 minutes.

But most of all, we understand the emotional surge of lift-off and the exhaustive catharsis of wheel stop. And there's no other workforce that figuratively holds its collective breath for the duration of every single mission.

"Beans and cornbread never tasted better …"

The Launches & Landings

"The thrill I get from watching a Shuttle launch today can only be exceeded by the thrill felt by those who lie on their backs and feel the seven millions pounds of thrust kicking them upwards into a glorious adventure that few will ever experience. We have witnessed spaceflight since the early 1960s with the first Mercury launch, but the Shuttle has truly given mankind, for the first time, the ability to soar into space and return home on outstretched wings – to literally 'fly' home. It is with great hope that the efforts of man and the knowledge gained from the Space Shuttle Program will help propel this nation into a new era of space travel and the next generation in high speed flight."

~ Danny Fitzgerald, Kennedy Space Center, 31+ years with the program

"One of the many memories I have of the Space Shuttle is a photographic image of Discovery landing at night in the high desert at Edwards in August 2005. It was the end of the Return to Flight mission, STS-114, the first flight following the Columbia accident. The image captured the Orbiter at a frontal angle at about 50 feet altitude, landing gear down, approaching at 250+ mph in the dark of night (without headlights of course!), illuminated only by ground lights. Two-hundred-thousand pounds of deadweight, sinking quickly, without engine power, controlled only by the APUs and hydraulically operated Flight Controls, and piloted by Commander (and Mrs., Mother and Retired Air Force Colonel) Eileen Collins … An amazing machine and an amazing machine-human interaction!"

~Paul Grout, Houston, 22 years with the program

"You just can't deny the rush of emotions that run through your head in those initial seconds after launch when you hear 'Endeavour has cleared the tower.' You stand and watch and listen to the cheer that comes from the thousands of KSC employees crowding the real estate to do the same as you, witness the launch of the Space Shuttle. Godspeed Endeavour! Beans and cornbread never tasted better!"

~ Jimmy Cornejo, Everett, WA, 14 years with the program

The Launches & Landings

"I was an STS-5 Space Flight Awareness honoree and got to attend the launch with my husband, Jim (also a Boeing employee). The viewing site was much closer back then (prior to STS-51L). When the Shuttle launched, there was an incredible rumble that rattled us to the bone. The ground shook like an earthquake (which explained why the loudspeakers were held in place with sand bags). After the roar subsided, you could hear a popping sound from the propellants until the vehicle moved too far downrange. It remains the most exciting event I've ever attended."

~ Pamela Pendergrass, Houston, 27 years with the program

"Every Shuttle launch and landing has been and is, until the final one, a significant experience creating memories that will never be forgotten. For someone who was born and raised in Africa, it is an experience for which I am very grateful and one that makes me so proud to be an American."

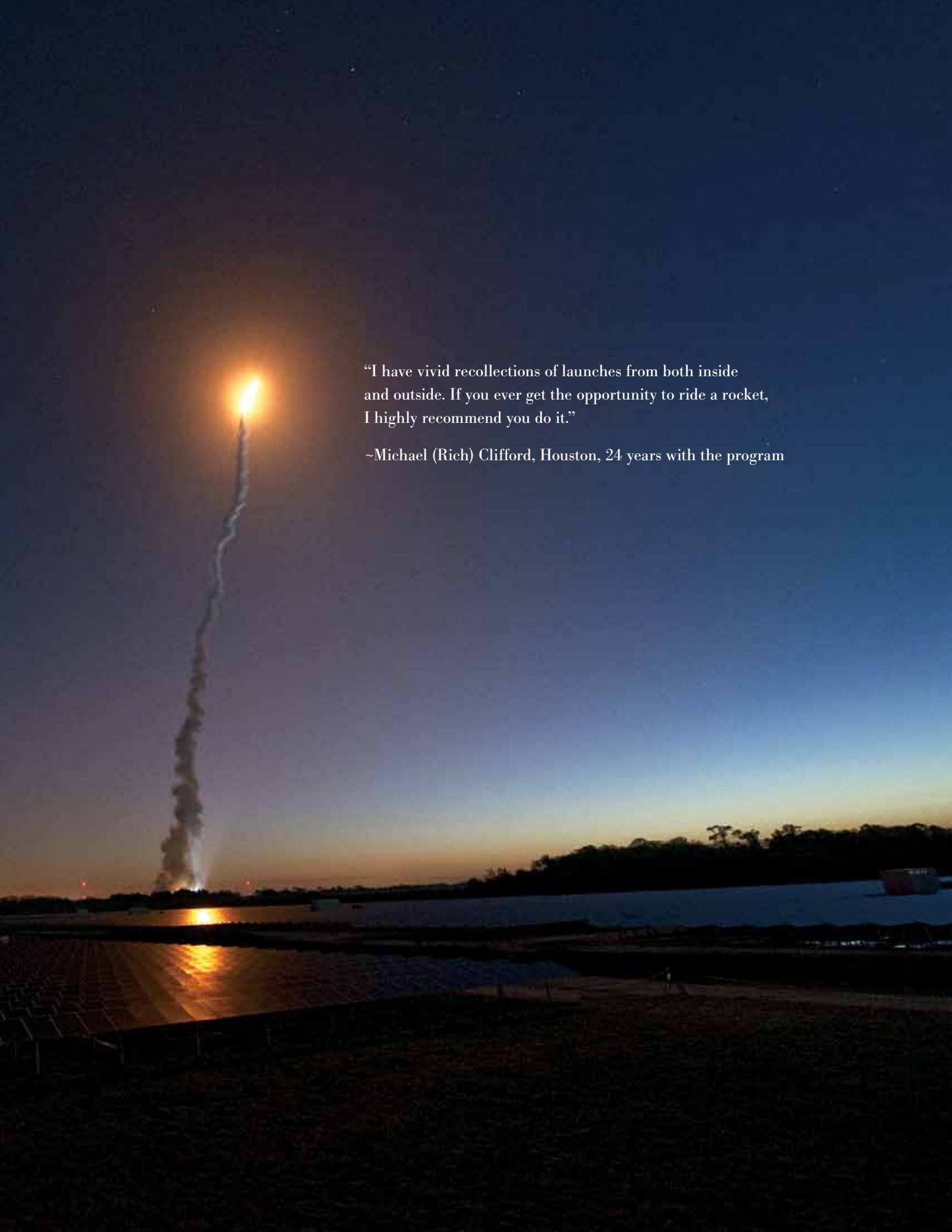
~ Milliana Phifer, Kennedy Space Center, 11 years with the program

"I have two memories to share. The first launch I supported was STS-6, which was also the first night launch and quite spectacular, although visibility through the Firing Room window was not the best from our consoles. I also remember the ninth shuttle mission, which experienced two APU failures during landing. The failures were traced to stress corrosion in a tube within each APU and I remember the major effort that went into resolving the problem in time for the tenth mission …"

~ Michael Myrick, Kennedy Space Center, 29 years with the program

"Some of the most memorable experiences working on the Space Shuttle Program were seeing my first launch in person (STS-5). It still never gets old, working the third shift of the first testing of the Ku Band system, getting to work my first launch as a console engineer in Firing Room 1. And sadly, being on console in that same Firing Room when we lost Challenger …"

~ William (Bill) Perkins, Kennedy Space Center, 29 years with the program



"I have vivid recollections of launches from both inside and outside. If you ever get the opportunity to ride a rocket, I highly recommend you do it."

~Michael (Rich) Clifford, Houston, 24 years with the program

"As part of loading propellants for the Orbital Maneuvering and Reaction Control Subsystems, I traveled to KSC to provide engineering support. Coincidentally, the launch of another vehicle was in its final countdown and as a result, the road from the airport to the processing facility was at a standstill. I listened on the radio as the final hold took place. I pulled over and we all watched this very small image of the Space Shuttle rise above the launch pad and into the sky. At first I was disappointed that I was unable to see this magnificent event from a closer location. The Shuttle was hardly visible from my vantage point. All those watching were clapping and cheering the vehicle on as it ascended into the heavens … Then suddenly a loud roar and a strong rumbling wave came and passed right through us. The cheers turned into a quiet astonishment. I felt my heart stop for a moment as the thundering sound of the SRBs flowed through and past my body … It is a moment I will always remember as a testimony to the extraordinary piece of engineering we have been blessed with these last 30 years.

~ Luis Toapanta, Huntington Beach, 29 years with the program

"Growing up in Houston, just miles from JSC, the Space Shuttle was a household name. Many of my family and friends have supported the program and with that comes a lot of pride. I finally got to see a Shuttle launch in person – the STS-131 night launch. I bought a special 360-degree camera lens to videotape the launch. I just had to hold the camera out in front of me and then I could watch the launch with my own eyes. And it was spectacular. A clear night. And the video shows my face in total awe, and the surrounding area lit up like it was a sunny day. The sound of the SRBs was thundering. You could see the fire from the engines almost all the way up to MECO … Awesome!"

~ Robert Galvez, Houston, 3 years with the program

"[My greatest memory was] when I saw a Shuttle launch … [standing in] the parking lot next to the VAB after working on the next flight's ET 17-inch valves …"

~Dennis Lytton, Palmdale, 25 years with the program

The Launches & Landings

"I was the prime nav instructor assigned to STS-51F and, with the rest of the team, observed the launch in July 1985 from the Simulation Control Area (SCA) next to the Flight Control Room in Houston. After a launch delay, the count picked up again and at T-minus-5 minutes, the SCA phone rang and the Sim Sup said, 'Mulder, it's for you.' Surprise #1 was that it was my wife, the only person I'd given that number to. And surprise #2 was that she said we were going to have a baby, which was followed by applause throughout the room … Shortly thereafter, Challenger lifted off and minutes after that, the prop trainer behind me said that the center engine was approaching redline. Surprise #3 was engine shutdown, following immediately by an Abort-to-Orbit – the only abort performed by a Shuttle. The Spacelab-2 mission continued and the crew made it home safely, but launch day was really exciting for a lot of people, myself included."

~ Tom Mulder, Houston, 28 years with the program

"I have three significant memories. I got to see several launches, which can only be described as unbelievable. I supported the Shuttle Program as we dealt with the Columbia incident through Return to Flight. And I participated in many Program Staff meetings representing IT. I really feel a part of this historic program, which has made a positive difference in the world."

~ Mark Magill, Houston, 10 years with the program

"My memories include managing the Wing Subsystem subcontract with Grumman Aerospace in Bethpage, New York, for more than six years; being selected as a Space Flight Awareness honoree for STS-74 in 1995 and witnessing the launch of Atlantis; being actively involved in making spaceflight history, and being a part of the first Space Shuttle flight, STS-1."

~ Randolph Rodarte, Seal Beach, 28 years with the program

The Launches & Landings

"When I first started working at the space center, launch and landing passes were plentiful. Since I had the opportunity to see several launches, including two from the turn basin, I threw my name into the hat for a landing pass. Lo and behold, my name was drawn and off I went in a NASA bus to see a landing. Many say launches bring tears to their eyes. Believe me, landings are no different. After we heard the famous double booms, we all looked toward the sky for the black-bottomed spaceship. Once spotted, our eyes never left the Orbiter. As it got closer and closer, much to my surprise, off to each side was an escort jet bringing the Orbiter to the runway. Then, just before the Orbiter touched down, the jets flew off the sides in opposite directions! It was a fabulous show … an unbelievable site that I'll never forget. Tears were streaming down my cheeks. I could not believe what I'd just seen … this spaceship, after being in space for days, had just landed at our airport! … As spectacular as launches are, seeing that landing was my greatest thrill in the 14 years I've been working at the space center."

~ Cheryl Gagliardi, Kennedy Space Center, 14 years with the program

"To me, the Shuttle Program has been a living being, affected by events and circumstances similar to human experience: life and death, triumphs and tragedies, breathtaking moments of awe and memories of those we encountered along the way. One memory … consisting of an infrared video image of the vehicle, post-wheel stop, complete with audio … was of flame-hot exhaust spewing from the APU ducts and the sight and sound of steam from the water spray boilers, chugging like a spent locomotive. The infrared image showed white on the hot spots of those ducts and main landing gear tires. By contrast, the landing gear struts showed darker, having been tucked away in the cooler confines of the landing gear compartment. Surprisingly, or maybe not, the nose cap and wing leading edges showed only as a mild gray, no longer bright white as they would have been 30 minutes or so earlier. If only we could capture the smell of still warm 'space molecules' coming off the ship … As with beings, now departed, which were a significant part of my life, the memories are vast and varied with the happy ones outnumbering the sad. Hopefully, there will be future occasions in spaceflight programs that will give others cause to remember Shuttle. And if someone remembers me by association, I will be pleased by that. I'm proud to have been a part of this."

~ Diana Coronado, Houston, 31 years with the program

"Although I remember the first Space Shuttle launch, I would have to say the most exciting was when I took my children to see STS-132. Growing up in Florida, I got to see a lot of launches and I wanted to be sure my children had at least ONE opportunity. By now, the program was coming to an end and everyone in America had a renewed interest in seeing a launch. I took the chance and made plans to go to Disney, the launch and the grandparents! I figured if we saw two out of three that wasn't so bad. We had to leave 5 hours ahead of time driving from Orlando. A normal 1-hour ride was about 2 hours to get to the launch viewing site. The traffic was absolutely crazy! After that, it was sit and wait 3 more hours. Since I had to pull the kids out of school for the week, they got to sit and do their homework. Something they were willing to sacrifice. The day was a perfectly beautiful Florida day. Then, the countdown started and the excitement was overwhelming, the blastoff just shook the earth under our feet and the kids had to put their hands over their ears. When the noise settled down, they both looked at me and said, 'Mom, this was well worth the wait. Put that video on YouTube!' And so I did. Along with about 900 other people with the same idea."

~ Pam Lyde, Houston, 20 years with the program

"STS-80 started out as a nominal mission, but on Thanksgiving Day (1996), the EVA crew couldn't open the B hatch. Over 16 launches, a #10-32 screw had vibrated out of the Columbia's hatch actuator assembly and jammed it. We spent the next week working around the clock to ensure the safe return of the crew. I will never forget the camaraderie and the non-stop, coast-to-coast team effort we stood up to bring them home …"

~ Paul Diggins, Houston, 15 years with the program

The Challenges

Anticipating the unexpected in the design phase is one thing. Actually addressing and mitigating the unexpected before, during or immediately after a mission is a lot more complicated and hair-raising when there's a finite amount of time in which to solve the problem or develop and implement a work-around with an acceptable level of risk.

Dedicated teams on console in the MER and engineering and ground support teams standing by to work problems in real-time are the de facto miracle workers of every mission. Their task, which is to provide the technical knowledge, expertise, elbow grease and, in some cases, creativity, to safely launch and return the crew and vehicle to Earth, qualifies all of them for "unsung hero" status with every mission.

More often than not, the acknowledgement they receive for their jobs well done, is a nod or a thumbs-up from a flight director, an Astronaut or a program manager. And they feel amply rewarded for their contribution to flight safety and mission success because, in the end, they don't work for recognition. Their satisfaction comes from solving a problem and knowing they made a difference in the outcome of a mission.

They work to meet and surmount the challenges inherent in manned spaceflight.

"I remember being a Level 4 test conductor on Spacelab D-2, the all-German Spacelab payload. One night during a test, while waiting for technician support to come back from break, I was asked by a McDonnell Douglas (now Boeing) engineer if he could adjust a ground support equipment camera located inside the module. He was preparing for an experiment test and needed to view and record the operations. We obtained the necessary concurrences to adjust the camera. As he was adjusting it, I suddenly saw on the monitor in the control room that the Spacelab was upside down and swinging back and forth. I heard the engineer state that he was all right, so I asked what happened. He said a bolt holding the camera to the mount had broken, the camera had fallen and was hanging upside down from its video cable. Thankfully, no pieces were missing from the camera. Both camera and mount were fixed that night, but the next morning we were both called in by management to explain what had happened because, unbeknownst by us, a grievance had been filed against us for moving the camera. We explained what happened and why. Nothing more came of it and D-2 had a great mission aboard Columbia in May 1993 …"

~Richard Acosta, Kennedy Space Center, 18 years with the program

"Mr. Hale would like to know …"

"For the last five years, I've traveled from Huntington Beach to Houston to support Shuttle missions from the MER at JSC. For STS-120, when they performed a repair on the International Space Station's solar array, I had just sat down at the thermal console in the MER at 4 p.m. when this group of people came in and started talking to the MER managers. Then this lady came over to me and said, 'Mr. Hale (the NASA Shuttle Program Manager) would like to know how much time the OBSS can survive without power in the repair orientation. He wants an answer by 8 a.m. tomorrow morning and he wants you to bring data to support your answer.' They needed the Space Station arm to hold the OBSS to reach the snagged area of the array, but the Space Station arm couldn't supply power to the OBSS … They figured that the OBSS would go below its temperature limits during the repair, but they just told us to forget about temperature limits and tell them how cold it would get. They were willing to sacrifice the OBSS to save the array … We did do an analysis of the OBSS in repair orientation, but it took about 48 hours. We finished the night before the repair was made."

~ Steve Thayer, Huntington Beach, 26 years with the program

"I've several memories. Working the Radioisotope Thermoelectric Generator (RTG) cooling loop for the Galileo and Ulysses space probes and coming up with the replacement coolant they used. Working mission support in the MSR at all hours of the day and night. Overcoming several challenges to get a micrometeoroid protection system installed to protect the Freon coolant loops while on orbit. Working the resolution to the flex hose buckling problem that sometimes occurred when the payload bay doors were closed … And then getting a Silver Snoopy and seeing the STS-123 night launch as a launch honoree … just for doing my part in the Shuttle Program."

~ Lon Harper, Huntington Beach, 24 years in the program

The Challenges

"The reusable ceramic thermal protection tiles were one of the cutting-edge technologies developed for the Space Shuttle Program. I remember the concerns we had regarding the fragility of the tile surfaces and the bonding strength and the complex entry heating interactions for a winged vehicle, among others. We conducted entry simulations with tile arrays with arc-heated gas mixtures at JSC and at NASA's Langley Research Center. Unsure of the exact peak temperatures the tiles would experience on re-entry, we took a conservative approach in testing the tiles to their limits with respect to surface temperature and shear forces. In the post-test examination of the tile test articles, we observed slumping and melting of the ceramic/glass tiles. As a young engineer, I remember a few of the older facility technicians telling me that the tiles weren't going to work and why not start developing an ablator system. Although I believed that the tiles would bring the vehicle through entry to a safe landing, I remember worrying that the vehicles might not be considered reusable due to extensive overhaul and replacement of hundreds, potentially thousands, of tiles on each flight … I will never forget waiting during the entry of STS-1 and then seeing the Orbiter appear on the TV screens, appearing white-hot, the glide to touch down and the remarkable condition of the tiles during the post-landing inspection. We lost a few tiles on the front of the OMS pod during that first flight and our team had worked the entry heating calculations for those areas during the two days on-orbit … STS-1 was a beautiful and historic mission."

~ Charles Ritrivi, Houston, 31 years with the program

"STS-27 suffered serious debris damage due to an SRB processing change for the nose cone insulation. I managed the investigation/reconstruction/validation efforts and made many presentations and trips … and received a NASA commendation for my efforts."

~ Edward Klein, Houston, 31 years with the program

"I remember the ninth Shuttle mission, which experienced two APU failures during landing. The failures were traced to stress corrosion in a tube within each APU. A major effort went into resolving the problem in time for the tenth mission …"

~ Michael Myrick, Kennedy Space Center, 29 years with the program

"On my second flight, STS-51A, I watched an untethered Astronaut fly a jet pack attached to a 'stinger' to a satellite left in a useless orbit due to a failed upper stage rocket. He docked to the satellite and began rotating with it. He fired some jets on his pack to halt the rotation and then flew it back to Discovery's payload bay where it was secured. This feat was repeatd a second time with another satellite on the same mission. I was running analysis for that flight to optimize the carbon dioxide scrubber replacement schedule and couldn't believe that I was actually involved in what seemed like a Buck Rogers story. The satellites were returned to Earth for re-launch, which saved millions of dollars and made the insurer very happy …"

~ Dan Reynolds, Houston, 26 years with the program

Rockwell/NASA's first big integration and operations working group meeting on the Shuttle/Mir program took place in Moscow in January/February 1994. We were to work out the final details of the first Mir mission, STS-71, and then focus on the next flight where we were working with RSC-Energia to construct an extension for the permanent docking location. Three engineers from Downey were to meet the NASA crew in New York for the overseas flight, but the East Coast was socked in with winter storms. When our NASA group did not make it to New York on time, we continued on alone. The large group from RSC-Energia that met us at the airport were surprised to see only three of us arrive. After the rest of our team arrived (through Stockholm), we worked hard the next two weeks. We got over jet lag. We slipped on the ice on evening treks to find some dinner. We went on weekend tours, saw Norm Thaggard launch in the Soyuz from the mission control facility, waited in line with Russians to see Lenin in his 'tomb,' and burned up every printer we had with us to print protocols. I made many trips back to Moscow through the Mir program but will never forget that first trip."

~ Sue Sheffield, Houston, 28 years with the program

"I remember standing inside the fence at Building 4 in Downey while an Astronaut who had just flown a failed part into Los Alamitos from KSC on a T-38, threw a box containing the part over the fence. We couldn't get someone to open the gate on the weekend and formally accept the part … so we 'found a way' … The part was through failure analysis by Monday morning and we had the answer we needed to build flight rationale …"

~ Dwight Woolhouse, Huntington Beach, 39 years with the program

The Challenges

"Although there were many experiences that were more memorable, I'd like to note one aspect that has always amazed me … Supporting the Shuttle flights in the MER involved monitoring one small computer screen filled with columns and rows of real-time numbers and acronyms. These numbers represented the current state of temperatures, pressures and speeds of our APU subsystem hardware. Comprehending the significance of a page full of numbers was a huge challenge … which ones were increasing, decreasing, by how much and within limits? In the last couple of decades, our technology has increased dramatically. We can now display multiple color-coded parameters to show changes over a period of time on three large screens and see the whole picture for the whole system. Being able to zoom from days to seconds, scroll back in time, expand or compress the value scales, instantly mark a value or show a slope of values, makes understanding the system and what's happening much easier and must faster! Advancements in the last couple of decades have been truly remarkable!"

~ Paul Grout, Houston, 18 years with the program

"As I reflect on my years on the Shuttle Program, one of the recurring memories, besides the exultation shared with my teammates upon each launch and landing event, is the feeling we experienced whenever an issue surfaced that we knew was going to ripple through and have a significant impact on the program's future … Moments such as the STS-93 Alternating Current Bus short circuit, the STS-112 pyrotechnic failure to fire, the 'Purple Plague' transistor contamination of the discovery of tin whiskers inside flight control avionics all come to mind. While the initial sensation experienced upon the recognition of such an event was one of anxiety and trepidation, we were ultimately able to meet each and every challenge presented us … We can reflect on our ability to overcome these setbacks and make the program better for having experienced them. The Orbiters are phenomenal vehicles that were designed, operated and sustained by a phenomenal team."

~ Paul Krause, Kennedy Space Center, 22 years with the program

"During STS-132, I supported the primary analysis shift as usual and found no ascent impact indication with significant damage risk. During early inspection on Flight Day 2, the Orbiter boom used to scan the wings for damage could not be properly positioned due to a cable snag. This resulted in limited coverage and resolution that prevented clearing the Orbiter from ascent debris damage. While an additional EVA was planned to free the cable, the Orbiter Project Office (OPO) reviewed the limited inspection results supplemented by other imagery surveys. On Flight Day 5, I briefed the OPO with additional results from WLEIDS, particularly on the risk of damaging impacts potentially masked by aero-acoustic noise during the period of high dynamic pressure. The results helped the OPO reach a consensus that the wing leading edge was at a low risk of having sustained any unacceptable damage and, as a result, ended several days of spirited debate on the appropriate action … An important lesson learned from the experience is that treating structural health monitoring as part of a probabilistic risk management framework enabled the Shuttle Program to realize the risk buy-down. Right after the OPO meeting, I received a surprise handshake and compliments from Bill McArthur, the OPO manager and former Astronaut. It marked the most memorable moment of my service at Boeing as it truly reminded me of the importance of safety in our line of work …"

~ Keng Yap, Houston, 6 years with the program

"One of my responsibilities was to take care of the Waste Collection System (aka potty) for the Orbiters at KSC. After each mission, the potty was removed, packed in a box and a shipping container and returned to the vendor for cleaning and testing and then returned to KSC for reinstallation into an Orbiter. The vendor reported that many shipments came back to them with a pair of rectangular holes punched in the box, which just happened to be the dimensions of the steel tines of a forklift. Since the potty sits in the middle of the box, the tines had not yet damaged it. The vendor sent me pictures of the holes, along with some engineering to reinforce the box to prevent potential damage. My job was to present the issue to gain approval for the modification. I received a resounding NO. So I pulled out all the stops and urged reconsideration based on potential headlines such as 'Shuttle Schedule Slips Due to Potty Damage.' Based on this potential PR debacle, my request was approved."

~ Douglas Lowen, Kennedy Space Center, 22 years with the program

"After a very successful STS-9 mission during post-landing touchdown, data suddenly started dropping out as I watched the strip charts that monitored APU performance. I thought the data acquisition system was going haywire until I noticed that only APUs 1 and 2 were affected. APU 3 was quite normal. We knew then that something had gone very wrong. Since the landing was at Edwards, I was assigned to drive up and find out what had happened. Upon inspecting the vehicle, I was absolutely astonished to find that both APU 1 and 2 had exploded causing peripheral damage to the surrounding hardware. This was the most horrendous failure in the history of the APUs! … After extensive failure analysis, it was found that both APUs suffered a stress corrosion crack in each of their high-pressure fuel tubes and leaked fuel during re-entry, leading to the explosion after touchdown. Luckily, the crew was safe and after a number of design improvements and process changes, the APUs continued to operate well for the remainder of the Shuttle missions."

~ Stan Barauskas, Huntington Beach, 38 years with the program

"In September 1996, I was alone on the APU console at Rockwell in Downey for the STS-79 launch. Atlantis and her crew of six lifted off on a mission to Mir to deliver supplies and to bring home Astronaut Shannon Lucid after completing a record 188 days in space. The APUs helped steer and throttle the SSMEs, then APU 2 shut down without being commanded! What happened? What should we do? Was the crew and vehicle safe? Could the mission continue? The mission team determined that the system was stable and the mission was completed successfully. Shannon returned on Atlantis and was replaced by John Blaha, but the Shuttle landed without APU 2 being restarted – the only landing of an Orbiter ever with one APU shut-off and the other two in high speed! I helped troubleshoot the APU and controller at KSC, but no problems were found. The hardware was sent to the supplier, where I witnessed it perform an ascent run without shutting down … however, one of three speed sensors failed. Redundancy allowed operation with one failure, but after several weeks of investigation, it was found that all APUs were mis-wired to allow APU shutdown if one particular speed sensor failed and the test stand, which was also mis-wired, was masking the problem. All APUs were rewired in all the Orbiters and Columbia flew the next mission on schedule."

~ Thomas Reuland, Houston, 27 years with the program

The Challenges

"After the Shuttle launched and landed it was always amazing to watch the engineers trying to figure out how to fix the problems the flight had … It was just a beehive of activity and they always worked out the problems. Very exciting!"

~ Diane Garrett, Seal Beach, 49 years with the program

"One of many significant memories in my 38-year career was during STS-9 at Pad 39A. The fuel cells were the first of the three sub-stack (96 cells) design and the first PRSD system with five oxygen and hydrogen tank sets. After LOX and LH servicing, tanks 4 and 5 experienced high boil-off rates caused by fluid transfer between the common vent and fill lines. Also after fuel cell activation, the potable water tank was filling at an accelerated rate, which was caused by the new fuel cell design permitting [the flow of] hydrogen gas through the water/hydrogen separator into the product water stream. Columbia was returned to the OPF after rollback from the pad and we worked around the clock to replace the three fuel cells, modify tanks 4 and 5 (fill and vent lines) and retest in less than one week … and beat the schedule for Columbia's return to the VAB!"

~ Timothy McCoy, Kennedy Space Center, 38 years with the program

"Back in the 1980s, I supported the Orbiter landings at Edwards and worked very closely with the ground support shop guys. I remember an instance during one of our California landings when the vehicle had just gotten back to the mate/demate facility and we were about to start our several-hour process of transferring the transporter ground cooling unit from generator power to the facility ground power system. But the transporter generator failed and created a very tense situation. We had only five minutes to get the ground cooling system back online or we'd have to perform an emergency vehicle power down. I remember thinking that there was no possible way to get it done in such a short time when the lead ground support technician came up and told me his guys could do it. Because of our close working relationship, I knew he was someone I could count on and gave him the go-ahead. I've never seen a crew work more efficiently than on that day. We got everything reconfigured and back online within five minutes, saving the Orbiter avionics from overheating or having to perform an emergency power down. I'm thankful to this day about how fortunate I was to have such a professional and competent team working with me on that hot day in the desert!"

~ Thomas Broughton III, Kennedy Space Center, 29 years with the program

"I traveled to Kennedy Space Center for the OV-099 Flight Readiness Firing (FRF) prior to the first flight of Challenger. My assignment was to analyze the hazardous gas concentrations in the fuselage and determine the amount of hydrogen leakage from the propulsion system. The results were not good. There was a significant leak that, if we flew with it, would lead to having an environment in the aft fuselage that would support combustion. I was a relatively new engineer and had to present the results to a large audience of NASA and Rockwell managers at the post-firing review. It took months of effort and a second FRF before the source of the leak was found and fixed. This problem led to the establishment of the propulsion helium signature leak test performed each flight, which enabled us to find unacceptable leaks prior to launch and increase vehicle safety."

~ Frances Ferris, Huntington Beach, 30 years with the program

"During STS-35, we had a hydrogen leak … We had taken a lot of the system apart to clean out contamination found during processing, so [we thought] one of those joints was probably leaking. Leak checks didn't find anything. Reviewing the data, I found that one joint had passed [testing] but was out-of-family with five similar joints. Although all six had been reworked, management said reworking only the out-of-family joint would support the launch date. The crew asked me to brief them (in quarantine) on our progress since we had already scrubbed the launch several times and they wanted the real scoop … I expected blue coveralls but what I got was Astronauts in tee shirts and underwear! I summarized our work and ended with the politically correct statement 'Management is confident that the source of the leak was found.' The Commander promptly kicked the photographers and everyone else out of the room and asked for my opinion. I told them and they said they hoped I was wrong … We loaded a couple of days later and the leak was less but still out of limits. I was impressed that the crew called the next day to say they were sorry I was right, but thanked me for being honest with them!"

~ John Frazer, Kennedy Space Center, 26 years with the program

"Early in the program there was a Detailed Test Objective (DTO) called the Primary Reaction Control System (PRCS) Narrow Deadband Test. During the test, because of all the PRCS rocket engine firings, the air-to-ground communications sounded as if the Astronauts were in the middle of an artillery barrage. The Astronauts also reported that it looked as if the orbiter body was flexing! It wasn't, but it was an optical illusion. They also reported that a lot of Foreign Object Debris (FOD) was being shaken loose from below the payload bay liner!"

~ Steve Arrieta, Huntington Beach, 31 years with the program

"I was in Building 9A listening to a tour guide explain the launch to visitors when Challenger launched that very cold January day. I stood there, heart-broken, knowing a terrible thing had happened, but couldn't wrap my brain around it …"

~ Tracey Shafer, Houston, 30 years with the program

The Losses & Recoveries

Our memories of the two worst days in the Space Shuttle Program's history are painful. And many of us choose not to dwell on them, although we all remember exactly where we were and what we were doing when we learned of the Challenger and Columbia accidents on January 28, 1986 and February 1, 2003.

We choose instead, to remember the heroic efforts that went into returning to flight and other milestone achievements of our Shuttle fleet. We choose to remember the program as a glorious, three-decades-long effort that achieved its objective.

In this way, we honor the fallen, their achievements and their families.

"I remember working the launch of Challenger, STS-51L. I was in the MSR with the Downey Team Leader and Room Captain. Things were pretty hectic up to the launch. And then the vehicle was lost and there was absolute silence. I remember looking at people's faces and the blank look everyone had looking at their monitors. It was a horrible, unbelievable event and a sad day for all of us on the Shuttle Program … and for the entire country."

~ Terri Uva, Anaheim, 20 years with the program

"I watched the STS-51L launch from the new Lockheed Logistics Building and could see the pad through a gap in the trees … I saw the explosion, a massive white cloud with debris. The building was so new there was no PA system … We saw the bad SRB going away from us through the debris and thought it was the Orbiter … We were praying RTLS and then it disappeared. We didn't know what had happened. It wasn't until later that afternoon that I saw the video on someone's small black and white television and realized that Challenger was gone. They brought all the debris to our facility since it was fairly new and empty. They put up plywood walls in the receiving area and laid out the Orbiter. They laid out the remnants of the SRBs and the ET in temporary hangars in the back parking lot … We saw the trucks coming in and unloading and I thought it was amazing how quickly barnacles had grown on the pieces. But the emotions culminated for me when the flag-draped coffins were driven from Hangar L to the Shuttle Landing Facility for their transport to their final resting places …"

~ Debbie McConnell, Houston, 30 years with the program

"We didn't know what had happened …"

"The thing I can't get out of my mind was looking out the Firing Room window during Challenger's launch and wondering why the boosters were separating so soon … Little did I realize what an impact that 'separation' would have on the future of manned spaceflight."

~ Jan Buker, Kennedy Space Center, 32 years with the program

"My favorite memory was watching the launch of Columbia, STS-1, from the viewing stands at KSC on April 12, 1981. My least favorite memory was being on console in the JSC MER when we lost downlink data from Columbia during the STS-107 re-entry … and realized that we had lost Columbia and her crew."

~ Tom Gederberg, Houston, 32 years with the program

"The event that stands out as the most memorable in my career as a Shuttle engineer was two years prior to the Columbia accident. My family and I attended a 'Family and Friends Day' at KSC. We got to meet and have our pictures taken with Mission Specialist David Brown. He talked to us about his upcoming mission (STS-107) … After the accident and the investigation, it was good to see the Shuttle Program Return to Flight after the two-year stand down …"

~ Michael Pullum, Kennedy Space Center, 12 years with the program

"One of my most vivid memories is actually a series of events just prior to the Columbia accident. I was only three months into my new job as Entry GN&C subsystem manager and the night before the landing I was on the phone explaining to my NASA Division Chief Engineer (DCE) why I had agreed to run gear-up landing simulations at the Ames Vertical Motion Simulator earlier that week … I got to my console in the MER at Johnson Space Center the next morning in time to hear the call over the loop that we had lost the first sensors in the wheel well. I walked past the Orbiter Project Office Manager and my DCE (who were still discussing our runs) to the MER Manager who was on a phone call – more nervous than I'd ever been in my life, but ready to make a recommendation on a call to the FCR. I never got the opportunity. The phone call the MER manager was finishing while we waited to speak with her was about CNN's breaking news on the re-entry …"

~ Jim Harder, Houston, 22 years with the program

"Immediately after the Columbia accident, I was requested and then assigned the task of supporting the Intercenter Photo Working Group Investigation Team and the Return to Flight Team activities. We worked very long days and the knowledge I gained from supporting these teams was at times overwhelming and very sad. I was often asked how I could work such long hours and my reply was that 'seven people became Astronauts knowing what the risks were and accepted the challenge … therefore, I could accept the challenge of working long hours to support the team investigating why the accident happened' … and how the potential for another one could be prevented …"

~ Beth Rysdyk, Kennedy Space Center, 31 years with the program

"My most significant memory is a sad one – the loss of the Space Shuttle Columbia in 2003. But an equally significant good memory is the Return to Flight effort after the Columbia accident. I was fortunate to see the launch live at KSC … and to support more than 100 Shuttle missions … an overall good memory."

~ Melki Moussa, Houston, 21 years with the program

"Of several proud and fond memories that stand out after having worked on the Shuttle Program for 39 years, the first one is meeting my wonderful wife when we were working at Rockwell back in 1982. The second one is the September 29, 1988 launch of STS-26, which was the first flight after the Challenger accident … My wife went into false labor the night before the launch and we had to go to the hospital. When we finally got home around 3 a.m., I received a call from the MSR in Downey that my help was needed to clear a problem with one of Discovery's wing leading edge RCC load indicators. I went into the plant and worked with the RCC team to safely clear STS-26 for flight … A few weeks later, we were blessed with a healthy son who, just recently, graduated with his Aerospace Engineering degree (it's in his genes!). I'm very proud of my son and my family and I'm honored to have worked on the Shuttle Program with so many great people."

~ Bill Novak, Huntington Beach, 39 years with the program

" … The Challenger accident and the work it took to Return to Flight. This was the most extensive engineering effort ever undertaken to understand the cause and effect … and the most rigorous failure analysis and fault tree study ever undertaken …. I was proud to be a part of the Shuttle Program's Return to Flight."

~ Harry Kolkhorst, Houston, 30 years with the program

"The most significant memories in my career were the two 'Return to Flight' missions of Discovery. I managed both of those flows for the Boeing team – one as Vehicle Project Manager and the other as Return to Flight Design Certification Review (DCR) Manager."

~ Bill Roberts, Huntington Beach, 30 years with the program

"The most memorable moment for me was the Return to Flight STS-114 mission. The wonderful people and the teamwork required to come to that moment were very inspiring."

~ Nelva Cary, Houston, 24 years with the program

"Like so many others, I had watched Columbia fall apart over East Texas. I came to Orbiter Safety and worked our Return to Flight activities proudly. I went through the certification process for MER support and requested permission to watch Discovery and her crew from the MER Safety console for STS-114 and I was overcome with relief and joy as I watched her return home safely … That moment, when Discovery's nose gear touched down and the entire MER erupted in cheering and applause, will remain one of the most defining moments of my career."

~ Mark Young, Houston, 6 years with the program

"When Discovery roared into the sky on the STS-114 Return to Flight mission, I remember vividly the dedication and intense scrutiny paid by the devoted experts to ensure she was safe. In GN&C engineering, supporting the redundant systems that ensure a safe flight has been a wonderful experience … I will miss most the camaraderie, dedication and commitment to excellence of this one-of-a-kind launch team …"

~ Linda Herrera, Kennedy Space Center, 14 years with the program

"The entire experience is memorable to me because as a boy, growing up in the farmland of Southwest Georgia, I dreamed of working for NASA as I watched Gemini and Apollo news reports by Jules Bergman of ABC News. However, doing my part in supporting the successful post-STS-51L Return to Flight mission of STS-26 is one of my most significant memories."

~ Ernest Turner, Kennedy Space Center, 26 years with the program

"There are many great memories for me, but two of the most significant have to be the Return to Flight missions after the tragedies of STS-51L and STS-107. Those particular missions, STS-26 and STS-114, were most significant because the team was back and we had overcome the problems to be able to continue the Shuttle Program mission. I will never forget those days and the pride we all felt to be part of those efforts."

~ Lee Griesemer, Kennedy Space Center, 29 years with the program

"STS-114 was the Return to Flight mission following the Columbia accident. Due to potential weather issues, the vehicle landed at Dryden (Edwards) instead of the normal Shuttle Landing Facility site at Kennedy Space Center. The Orbiter Mass Properties group supports the ferry operations and calculates the mass properties for the vehicle for the Shuttle Carrier Aircraft pilots and flight engineers. During the ferry preparations at Dryden while Discovery was in the mate/de-mate device, it was rained on twice, hailed on once and attacked by flying ants. The unpredictable weather conditions made for an interesting ferry readiness review."

~ Robert Hundl, Houston, 21 years in the program

"During STS-114, I was supporting the mission in the MER at JSC MCC. After a few days of challenging activities in working issues at the MER, toward the end of the mission on Friday, August 5, 2005, as I was watching Discovery orbiting Earth and her crew going through their final mission activities, I realized that years of unfailing effort by thousands of the most talented engineers in the world, and the support of hundreds of the most dedicated people in the world, were focused on one common objective – discovery and improvement of life on Earth … and in that moment, I hoped for this vision to continue and never stop …"

~ Javad Elahi, Houston, 8 years with the program

"The proudest moment of my career at Rockwell was when I was chosen to attend a launch at KSC in August 2009. The rumbling of the ground, the excitement of the crowd and moment of launch … a truly incredible memory."

~ Yolanda Paris, Huntington Beach, 27 years with the program

The Achievements & Pride

People are called to the space program. And those of us who have dedicated our careers to manned spaceflight are willing to follow our dreams to wherever they lead — low Earth orbit and beyond.

We understand that to participate in this ultimate exploration is both an honor and a challenge. Because although the Space Shuttle's airframe makes spaceflight look easy to the general public, we know it's not. We are intimately familiar with the complexities and the risks. Failure is counted in billions of dollars and at the cost of human lives.

For many of us, these remarkable achievements of launching and landing such a vehicle, and of successfully conducting the most complicated construction project ever imagined, much less completed, are reward enough. The pride we feel when we watch a rollout, a launch, a landing, a ferry flight, when we see all our efforts come together in a successful mission serves as our thanks. While the public wonders at the spectacle, we congratulate ourselves for having played a pivotal part in it.

But the work we do is not unnoticed by NASA or the people whose lives depend on our diligence. And on the special occasions when we are on the receiving end of the program's thanks, when we are formally recognized for our good work and our commitment to safe flight, it brings all our efforts, long hours, trials and tribulations into humbling crystal clarity.

We do the work because we believe it is our charter to explore outside our world. We are spacefarers.

"Working at KSC, I have witnessed teamwork and dedication in every area. From the first time I climbed into the Orbiter cockpit, goosebumps and chills ran up my spine. The complexity of this amazing machine left me speechless. After learning the locations of all the switches and controls for Spacelab in the Orbiter [in a horizontal orientation], and then finding I was completely disoriented the first time I attempted the same task vertically at the pad, shocked me. Climbing through the transfer tunnel between the Orbiter and the Spacelab module was definitely not for those squeamish about confined spaces. There were long nights spent in the Shuttle at the pad ensuring the safety of the experiments … and I remember going back to the pad late in a countdown to monitor Spacelab while a communications box was being replaced. Close to launch, the ship was alive with sounds as it strained to contain the power within. Later, watching her soar into the skies made me very proud of what this team accomplishes with every mission."

~ Linda Herrera, Kennedy Space Center, 14 years with the program

"It's humbling to realize how fortunate I was to have participated …"

"I started out my career spending shifts in the MER providing engineering support for Shuttle-based Space Station assembly spacewalks. Seeing the effort behind building the station in orbit was amazing. It was only later when I moved into directly supporting the Space Shuttle that the full impact of our accomplishments hit me … a trip out to KSC gave me the chance to see the Shuttle in person. Glancing up to see the Orbiter's black protective tiles just above my head, looking up at the SRBs stacked on the MLP deck, or walking along one of the VAB catwalks to look over and see the tips of the SRBs. Then later standing out on the pad on the crew escape level, getting a great view of Florida and also realizing that's where the Astronauts have walked … It's been a great honor and privilege to support the United States' manned spaceflight programs. This journey has been inspiring and motivational!"

~ Camela Dutton, Houston, 11 years with the program

"Since I first started working on the Shuttle in 1973, it's difficult to choose one significant memory or experience … However, from an engineering perspective, the one personal shining memory I have is the 1984 flight of STS-41C. It was the first direct insertion mission, the first Shuttle rendezvous with the malfunctioning Solar Max solar satellite and there was a DTO to target the ET entry off the coast of Hawaii. I was involved with the mission planning and I can remember an overwhelming feeling of satisfaction sitting at the MCC backroom console after each one of these events was successfully completed …"

~ Guy Hirsch, Houston, 38 years with the program

"I consider myself lucky to have supported the Space Shuttle Program with two organizations. I retired from NASA in 1998 and began a second career with Boeing working on the International Space Station and later on these remaining launches … After working as the Prime Payload Manager for the Space Station, serving as one of three flight managers for the KSC Engineering Support Room, my last assignment has been System Engineering & Integration Requirements for all Launch and Landing Systems for KSC … It has been an extremely satisfying and fun career with both NASA and Boeing. I'm sorry that it has to end!"

~ Wayne Owens, Kennedy Space Center, 37 years with the program

"After more than 14 years working on the Shuttle Program, I finally got to see my first launch. It was John Glenn's flight and I remember that feeling of pride in knowing that I had a very small part in getting the Shuttle into space!"

~ Dennis Veselka, Kennedy Space Center, 29 years with the program

The Achievements & Pride

"The memories are too numerous to record. Knowing what we did with the Space Shuttle Program will be something I'll keep with me always. We made HISTORY!"

~ Bettye Richardson, Kennedy Space Center, 29 years with the program

"I have participated very enthusiastically in the Space Shuttle Program to make sure that each and every mission was safe for the crew."

~ Ashkan Azarsepandan, Houston, 3 years with the program

"Shortly after joining the Orbiter processing team, I was assigned to a role that placed me in Firing Room 2 with the SE&I Management Team. I had never been in a position to have access to the Firing Rooms during launch or experience a Space Shuttle launch from the Launch Control Center. It was hard to contain my excitement as I stood at the window for a night launch … watching night become day and feeling the vibrations as the sound wave hit the window. It was truly an amazing experience."

~ Mickey Roberts, Kennedy Space Center, 23 years with the program

"I'm proud to say that I have worked on the Space Shuttle Program my whole career. What a wonderful experience – from watching the Orbiters being built in Downey to the final delivery of Endeavour. While performing audits, I've had the opportunity to go inside the Orbiters and also wear a 'bunny suit' to see one of the vehicles filled with multiple payloads. It was also an experience to maintain the configurations of all the vehicles during fabrication, as well as maintaining the Crew Compartment Trainer (CCT) and Full Fuselage Trainer located in Houston. I had the thrill of going from vertical to horizontal in the CCT and being able to see my first Shuttle launch at night, and will have the opportunity to the see the last launch of Endeavour. It's so wonderful to be part of history, but so sad to see it all come to an end."

~ Karen Slider, Houston, 30 years with the program

The Achievements & Pride

"I have a couple of significant memories from my work on the Shuttle Program. First, being presented with the Silver Snoopy by John Young and Bob Crippen on December 1, 1980, for my work on the Pyro Shock Tests was a very proud moment in my working life. And second, the outstanding effort the Landing Team put forward in the recovery of Columbia and returning it to KSC after its landing at the White Sands Northrup Strip on March 31, 1982 …"

~ Otto Baker, Kennedy Space Center, 32 years with the program

"The first year I worked at KSC I remember walking out of complex H and watching Discovery launch on April 12, 1985. The next day, Atlantis was rolled into the OPF and the following day Challenger was rolled out to the pad. I stood there in awe of all the spacecraft we were moving around every day! The feeling of pride, passion and excitement that I felt that day will never be rivaled."

~ Tim Boltz, Kennedy Space Center, 26 years with the program

"My top memory was observing a Shuttle launch with my wife as a launch honoree for STS-65 on July 8, 1994, which was also our 34th anniversary! Memorable experiences included providing noise reduction/control of crew life support equipment … on one occasion, this work required entering the Orbiter just prior to launch and identifying a noisy avionics fan that would have failed during the mission … Another event resulted in saving $96 million by establishing a method to extend six ship-sets of equipment beyond their qualified life …"

~ Robert Hill, Huntington Beach, 30 years with the program

"I have loved my career ever since the first day I set foot in Building 5 and have always had a tremendous sense of pride in my part of this historical endeavor, even if it only meant keeping track of stock and assets and cleaning simulators. My old friends in Building 5 are now dismantling and marking assets to be shipped to museums … not assets to us, part of our history and part of our lives!"

~ Tracey Shafer, Houston, 30 years with the program

The Achievements & Pride

The Space Shuttle was not a simple extension of previous launch systems. It was a technological leap of the imagination and a tribute to the ingenuity and hard work of the men and women of the engineering and management teams dedicated to human space exploration … How unbelievably exciting it was, after years of trade studies, computer simulations, tests, design options, meetings and yes, paperwork, to sit on console to observe your efforts stream by in down-listed numbers on a small screen and catch glimpses of the vehicle disappearing as it climbed to space on an equally small video screen … Pride. Pride in the team. Pride in accomplishment. Just an overwhelming sense of pride …"

~ Lambert Austin, Jr., Houston, 44 years with the program

"Since I came to NASA in 1980, I was fortunate enough to be part of the first Shuttle launch. That was a very significant event in my support of the Shuttle Program. I worked in Building 4 on site (JSC) and saw, first hand, all the training and work required for that first mission. I remember the jubilation after that mission and the teamwork involved in all the remaining missions. But my most significant moment was when I was awarded the Silver Snoopy for my support of all Shuttle missions …"

~ Rachel Cheatham, Houston, 31 years with the program

"My work at KSC has taken me many places and I have performed many functions. One of my most significant memories is my contribution during the Return to Flight period following the Columbia accident when I participated on the team that reviewed all electrical Work Authorization Documents (WADs) for possible contribution to the accident. Following that, I worked to integrate the OBSSs requirements with Cargo Services for the STS-114 mission. But a most memorable occasion was when I received the Space Flight Awareness award for sustained superior performance."

~ Christopher Madore, Kennedy Space Center, 29 years with the program

"One of my fondest memories is when I attended the rollout of Endeavour as a Rockwell special guest while I was serving on active duty in support of Desert Shield/Desert Storm. I was doubly proud to be at that ceremony."

~ Dennis Sherman, Houston,
24 years with the program

"I've been honored to have spent many hours working on a small piece of history. I'm proud to say that my career on the Space Shuttle Program has been a memorable experience … the trips to Palmdale to witness the OMMs in progress, walking around, above and under this amazing piece of engineering … Working in the logistics area and handling thousands of parts that ultimately were installed on these incredible vehicles … Meeting such a great bunch of people and making many friends along the way. To top off my career, I've been selected as a Space Flight Awareness honoree and will travel to Florida to witness the launch of Endeavour (STS-134)!"

~ Ronald Slider, Houston, 29 years with the program

"Over the years that I had the privilege to work on the Shuttle Program there were several memorable experiences, like attending my first Shuttle launch and the completion of Endeavour in Palmdale. One of my favorite memories came from riding the MLP from the VAB to Pad B. This is when the magnitude and complexity of the program really hit home for me … It takes over 12 hours to complete the trip to the pad, which allowed me plenty of time to see the crawler, MLP, and Shuttle system from every vantage point. The size of the Shuttle system is astonishing with this first-hand perspective. Inside the bowels of the crawler, you see the technicians operating an engine plant large enough for a factory. Walking beside the vehicle, you see the huge tread plates in operation, each of which weigh a ton! And up on the platform, you crane your neck to see the top of the vehicle, 184 feet above. Dawn was just breaking as we reached the pad and it was a tremendous spectacle. … What also hit home from this experience is the wide range of employees that are needed to make the system work. Our design engineers developed an incredibly capable system, our manufacturing team was able to build that system despite its complexity, and the support teams ensured that all of the business and operations processes were in place to enable the Shuttle to fly for decades. The success of the Shuttle system is a testament to the skill and dedication of our work force. I am very proud to have been a part of this team."

~ Russ Turner, Downey & Houston, 15 years with the program

The Achievements & Pride

"During the periods that we had the Orbiters in Palmdale for structural inspections and modifications, we hosted many people for tours – elected officials, community leaders, teachers and school classes, scout troops – they all got an up-close-and-personal look at our magnificent machines. One of the most frequently asked questions, as we walked along the starboard side of each vehicle was 'Why is that flag on wrong?' Smiling, I always responded by saying 'Imagine this spaceship as a big American flag flying around the world proudly displaying what is great about our country … and tell me how that flag should appear if you're on this side of it as it flies?' That was one common question in many. The kids were always the best. For those of us volunteering our time to share the Orbiters with them, it was invigorating!"

~ Al Hoffman, Palmdale, 24 years with the program

"I was working as a Field Engineer in nuclear power plant construction in Illinois when I heard the bad news about the Challenger accident. It was the worst feeling I'd ever felt in my life … I never dreamt that someday I'd be a part of the program and be working on these one-of-a-kind spacecraft … I remember hearing about a Rockwell open house in Downey … I just walked into Building 4 and the rest is history … I'm proud to be part of the Space Shuttle legacy …"

~ Roger Justiniani, Huntington Beach, 24 years with the program

"Among my most exciting and memorable occurrences … watching the launches and feeling so much pride in knowing that I had participated, in a very small way, to reaching the milestone to launch; and receiving the Space Flight Awareness launch honoree award for STS-121 in 2006 … But overall, most rewarding was being a member of the Boeing team and working with a great group of folks!"

~ Beth Rysdyk, Kennedy Space Center, 31 years with the program

"You know, I've given most of my life to this program and am extremely proud of what we have accomplished here. I wouldn't trade the experience for anything!"

~ Jan Buker, Kennedy Space Center, 32 years with the program

"I consider my time spent working on these great vehicles with such a gifted team of professionals a fulfillment of a childhood dream and a tremendous blessing in my life."

~ Tommy Westergard, Houston, 10 years with the program

"I had programmed all the major sections of the Integrated Wiring Validation Test for the Shuttle fleet. The programming of Discovery (OV-103) for the DIT-MCO testing was my career lifetime achievement … A zero programming error was attained for the task …"

~ Gary Seetoo, Huntington Beach, 36 years with the program

"In 1984, I supported Shuttle integration of the U.S. Navy's Leasat F1 satellite (leased from Hughes). Hughes was my first job out of school and this was my first launch. Two life-long memories I'll always have are going out to the pad early in the morning just to watch the sun come up and look out over the Florida wilderness surrounding the pad, and taking the 'riggers' (the ironworkers who did our heavy lifting) out to the pad and seeing the tears in their eyes from the overwhelming combination of seeing the massive gantry iron work and the realization that they were really a part of such an impressive symbol [of the American space program …]"

~ Rick Lyell, El Segundo, 1 year with the program

"As the Shuttle Program comes to a successful end, it brings up many memories. I remember being in college and dreaming of being able to get a job with the Shuttle Program … and then to my surprise my first job out of school was on the Shuttle Program. As I was then, I am still so proud to be involved with the space program. The first flight that I was part of was STS-26, the Return to Flight mission after the Challenger accident. The whole program was focused on each major milestone associated with the successful Return to Flight. I still remember the pride we felt as the Shuttle returned safely home … I'm sad to see the end of the Shuttle Program, but excited to see where we go next. I hope we continue to 'boldly go where no man has gone before' …"

~ Karen Harrison, Houston, 17 years with the program

"I was in the USAF F-16 Joint Test force stationed at Edwards when I first saw a Space Shuttle. Columbia was being towed down the taxiway to be mated for delivery to KSC for its very first flight. I remember thinking how boxy it looked compared to the F-16 or the X-15. Working on the Space Shuttle Program was the furthest thing from my mind at the time … After I joined Rockwell in Downey in the Project Office, I attended Endeavour's awesome rollout ceremony in Palmdale. And after moving to Houston, my wife and I were at KSC for the launch of STS-74 as an SFA honoree … We were wined and dined for a week. The launch and event were fantastic … I also worked several flights/shifts in the JSC MER at the Boeing console, which was a great experience … The low was when I was standing behind our Instrumentation Engineers in the MER when the measurements started dropping out during Columbia's re-entry … One of the highs was touring the VAB and witnessing Discovery's rollout to the pad for STS-114 while working in the KSC RTF Action Center. But most of all, I will always remember the quality of the people who were willing to educate and share their experiences with me to help advance my career … It was pleasure to work with each of you."

~ Randy Moore, Houston, 27 years in the program

"[My most significant memory is] being able to work the whole Orbiter flow. From processing in the OPF, the VAB, the launch pad, landing and recovery at Edwards AFB. It was customary to have the Astronauts sign a dollar bill on visits. I have many of these … "

~ Tom Funk, Mesa, Ariz., 1 year, 7 months with the program

"As the Boeing IUS Launch Team Coordinator beginning with the Program's return to flight in 1988 through 1993, the highlight of my career was when I supported the three planetary missions (Magellan, Galileo and Ulysses). I will always remember the day I witnessed my first of many shuttle launches from atop a steel building overlooking the Eastern Launch site at the Cape – the building rattled, the earth-shattering sound of the liftoff and the earth moved. I thought my heart would never stop racing. At that time and to this day, I am so proud to be a Boeing employee and honored to be an American."

~ Sharon Brown Swanson, Seattle, 15 years with the program

The Achievements & Pride

"So many memories … The first launch was magnificent. The Challenger accident was heartbreaking. The rework of the Extended Duration Orbiter Carbon Dioxide Removal System during flight was exciting. The unit had failed early in the mission and an alternative operation was implemented in flight. Galileo images of the probe deployment were amazing and the Hubble images are still breathtaking … "

~ Michael Fuller, Kennedy Space Center, 31 years with the program

" … I am an infant in the Space Shuttle family. I got the opportunity to work on something that I believe was and still is good for the country and the world. I wanted to be a small part of the history that is the Shuttle. I don't regret for a moment my decision to come and contribute what I could. I was lucky to be able to help teams with many Lean+ improvement projects, which demonstrated that there are always opportunities for continuous improvement, even after 30 years. It's a lesson for each of us. Best wishes for those moving on with their careers and to those retiring."

~ William Chapman, Houston, 2½ years with the program

"In my earlier years with the company, I worked in Contracts & Pricing. I worked on a proposal for purchasing the main landing gear tires for the Space Shuttles. Back then, I didn't fully appreciate the significance of my role to the program. But over the years, as I've seen Space Shuttles come in for landings, I've often thought back to that very special proposal that I helped put together … and I've been reminded just how important my task was to the overall mission of the Space Shuttle Program. As I've watched Shuttles come to a wheel stop, it's brought a smile to my face knowing that what each of us contributes really matters! I have no regrets about my service to America's Space Shuttle Program. I feel extremely proud and blessed to have had a part in our Space Shuttle legacy. It's a legacy that will live on forever!"

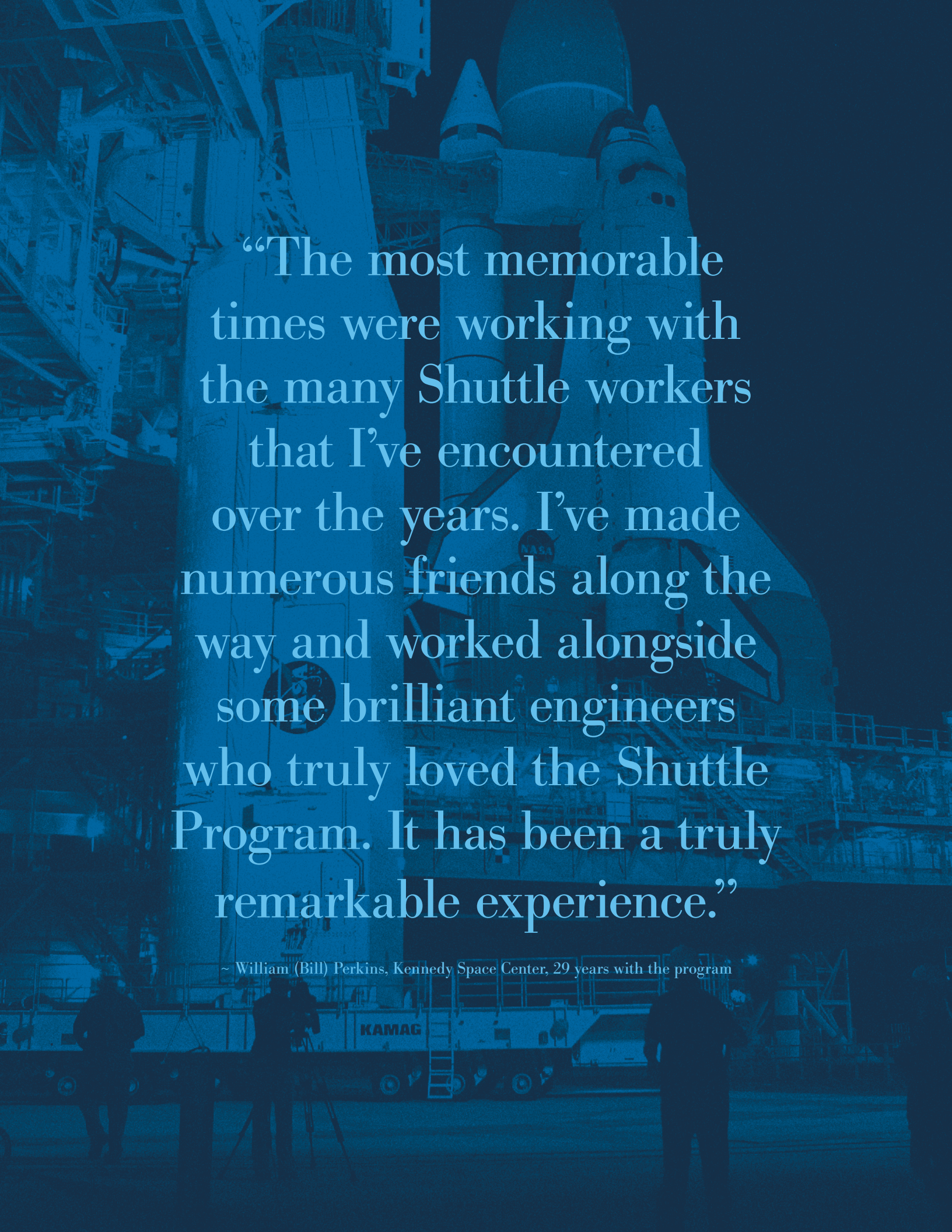
~ Janet Hanna, Kennedy Space Center, 22 years with the program

"One significant experience was upgrading Discovery with the 3-String GPS system, which required that we work directly on the spacecraft. But the most significant experience was receiving the Space Flight Awareness award for STS-69 (Atlantis)."

~ Robert VanSickle, Kennedy Space Center, 42 years with the program

"The launch and successful flight of STS-1 said it all … To realize the culmination of over a decade of effort dedicated to the development of a new and unique capability in the power and majesty of the vehicle launch was awe-inspiring … and it's humbling to realize how fortunate I was to have participated in the evolution of the design, development, certification and flight operation of the first reusable spacecraft.

~ Lambert Austin, Jr., Houston, 44 years with the program



"The most memorable times were working with the many Shuttle workers that I've encountered over the years. I've made numerous friends along the way and worked alongside some brilliant engineers who truly loved the Shuttle Program. It has been a truly remarkable experience."

~ William (Bill) Perkins, Kennedy Space Center, 29 years with the program

Work Teams & People

Truly a tri-coastal effort, teams from North American Aviation-Rockwell-Boeing-McDonnell Douglas and a host of other legacy aerospace companies came together mainly in California, Texas and Florida to design, develop, test, evaluate, certify, fly, modify and recertify the Space Shuttle fleet. And these work teams, each carrying a standard for quality and perfection, handed off to each other without pause or doubt, from the very beginning of each Orbiter's life to its ultimate retirement.

We are experts in all engineering disciplines and in program management. We mastered the art and science of negotiating, securing and executing government contracts. We learned how to operate at the leading edge of technology and rewrote the book on aerospace development. Our efforts and our talents, knowledge and skill sets helped redefine space exploration.

In the end, the Space Shuttle Program is not just about our Orbiter fleet and the 135 missions we completed or the amazing orbiting space laboratory we helped build with our international partners. The Space Shuttle Program is more about the driving force behind it. SRBs, ETs and SSMEs notwithstanding, what really powers the Shuttle fleet are people.

The Space Shuttle Program has always run on us.

"I have enjoyed every aspect of our Shuttle heritage. The commitment of the employees to the highest level of safety in all their products is awe-inspiring. NASA and their contractors all working toward one goal defines teamwork at the highest level. My most memorable moments are those when something I did contributed to another team's success … During STS-49, the crew failed to capture the IntelSat during two separate spacewalks. I was on the EVA contingency crew and, overnight in the water tank [Neutral Buoyancy Lab], we developed and tested the capability of supporting three EVA crew in the Shuttle airlock, and defined the procedural positions in the payload bay that would allow the crew to manually capture the rotating satellite. The photos and procedures were faxed to the crew and to watch the crew successfully use the manual capture technique on their last EVA was a defining moment."

~ Michael (Rich) Clifford, Houston, 24 years with the program

"…Mainly I think about the unique and dedicated people …"

"STS-1 had been scheduled and rescheduled several times because of TPS issues and other hardware problems. As the latest target launch approached, I was invited to a 'mystery' meeting in the Downey Executive Conference Room. As the junior team member in attendance, I sat in the very back of the room, against the wall, as inconspicuous as possible. At the conclusion of the meeting, after he had polled all the directors in the room, Sy Rubenstein, Rockwell's VP and Program Manager, who was chairing the internal Rockwell review of Columbia's flight readiness, turned around in his chair at the 'Power Table,' looked directly at me and asked me, by name, if I was aware of any unresolved issues that had not been covered in the meeting. I was floored that he even knew my name, let alone that he was interested in my comfort level with flight readiness of the spacecraft we were all working on night and day. But he did and he was. I never forgot that moment and my admiration for Sy remains strong to this day."

~ Dwight Woolhouse, Huntington Beach, 39 years with the program

"My most memorable times were supporting STS-100 along with ISS 6A for the International Space Station at the same time. I spent time with Astronauts in training, hooking up power cables using NZGL connectors to the hardware we had built here in Huntington Beach in the Building 46 high bay. Those were the most exciting."

~ Maryhelen Dawes, Huntington Beach, 25 years with the program

"My greatest experience was preparing for, and then working, the integration of Space Station elements in the second Multi-Element Integrated Test (MEIT-II), which took place in the brand-new Space Station Processing Facility (SSPF) at KSC. The test included fitting multiple elements of the Space Station Modules together, along with several 40kW DC power supplies, tons of test equipment, a room full of test coordination and management computers. The MEIT II involved dozens of support personnel running integrated tests around the clock for several days … just to prepare the modules to be carried by the Space Shuttle to build the new International Space Station."

~ Thomas Sobey, St. Louis, 12 years with the program

"I remember our team adding the safety hatch to the 17-inch disconnect to eliminate a scary crit-1 failure mode … the water flow testing at Wyle, separation test at Saugus and finally its first flight, STS-26 … I remember Harv LeBlanc, Larry Kauffman and Dick Thomas as the best bosses a young engineer could ask for … and two guys named Tibor in the same department! I remember the old-timers like Sid Glasser and Robbie Robertson who understood why things were designed the way they were and who were happy to share it with you … going to Alma's for Italian food and then working after midnight in the VAB for Orbiter/ET umbilical mate … [I remember] briefing at the Level 1 FRRs and wondering how out of line it would be if I were to ask John Young to autograph my briefing package … and trying to explain a technical issue to Dan Germany and knowing that I'd missed the mark when he responded in his Texas drawl, 'Son, that dawg won't hunt …' And of course, Dick Thomas passing me in the hallway and asking 'How is the Major Problem System today?' meaning the Main Propulsion System … A great program and great people."

~ John Kremer, Huntington Beach, 16 years with the program

"I loved working with a great team on an amazing project and really liked to see my product in operation … and enjoyed hearing great feedback from the Shuttle engineers."

~ James Mordarski, Aurora, CO, 3 years with the program

"Just being involved with the space program has been such an honor. I have met so many wonderful people!"

~ Diane Thomas, Kennedy Space Center, 10 years with the program

"It has been an honor to have been involved with the human space flight program for the majority of my career and to have worked with such dedicated people throughout the years."

~ John Smith, Kennedy Space Center, 27 years with the program

"My whole family has participated in the Shuttle Program. My dad, Beryl Clements, worked for NASA. My husband, Terry, and I have both worked on the program. I met President Jimmy Carter and President George Bush (when he was Vice President to President Reagan) when they each came to Kennedy Space Center. My son, Rick, was in the movie 'Contact' with his marching band and my daughter, Mindy, was an extra in the TV show 'The Cape' – both of which were filmed here. My daughter met her husband while working for United Space Alliance … the Shuttle Program has been our life!"

~ Jane Pratt, Kennedy Space Center, 31 years with the program

"The most memorable experience has been to include my own child in the love of the program. My son, Scott was born in 1982 and was fortunate to be exposed to all the wonders of spaceflight. Not only did he love watching and learning about space, he was able to interact with some of the brilliant engineers of the program. When he was 17, he procured a part-time job in the Space Flight Awareness office where he also interacted with the Astronauts who came to visit. Who would have thought that he could work part-time and watch his dreams come true … just awesome! As a parent, to see your child go from infant to adult and be part of a wonderful program that will never happen again … that is my most cherished memory …"

~ Sandy Pilon, Huntington Beach, 37 years with the program

"When I look back on the program, the technical achievement of the Shuttle team is amazing. It will be many years before anything like it in space will be realized. But mainly I think about the unique and dedicated people. What a tremendous group to work with! I think about the true leaders of the past like Dick Thomas and Sy Rubenstein. Dick Thomas knew more about the Shuttle than 100 engineers and he was a great guy to work with. And I remember before STS-1, Sy Rubenstein 'polled the room' in a Downey meeting to see if each person was 'go for launch.' And he called on me, a lowly project engineer. I know it was a courtesy, but it made me feel great. Sy knew how to lead."

~Larry Kauffman, Huntington Beach, 33 years with the program

"I spent 29 years working on the Space Shuttle Program. For me it began with the Phase B Definition Program (1970) and ended when I retired in 1999. There are so many highlights … the Shuttle C/D Proposal and Award, Approach and Landing 1st Flight, STS-1 Launch and Landing, STSOC Proposal and Award, STS-26 Return to Flight and Endeavour Manufacturing/Delivery and 1st Flight … These are only a few of so many great experiences for me. When I step back and look at the Shuttle I feel privileged to have been a part of the program because of what it was capable of doing – launching, payload delivery to orbit, crew operations, experiments, repair on orbit, payload return, entry, runway landing and reusability. So many challenges and such a fabulous vehicle … the very best of my experiences was working with the people on the program, so many talented people that worked so hard and with so much enthusiasm. This is the bottom line of what has made the Space Shuttle Program so special and why it has been so successful for so many years!"

~ Bob Minor, Downey & Houston, 29 years with the program

"Just like a small puzzle piece to a really big puzzle, I was a small piece of a big team on the Shuttle Program. Working in Contracts & Pricing under the business element of the program, I interfaced with all the functional elements of the team. I worked with project design, stress, system and thermal engineers, lab technicians and chemists … What a thrilling career to have worked with people who were all extremely committed and so passionate about what they were doing … As I look back, I consider myself very fortunate to have been part of the Space Shuttle Program. So many memories – from working the long hours to hearing the double sonic booms when the Orbiters would land at Edwards …"

~ Sharon Stacy, Huntington Beach, 26 years with the program

"I started work at Cape Canaveral in August of 1981 on the Inertial Upper Stage (IUS) program. My very first encounter with the Shuttle was processing Pathfinder Test Vehicle (PTV)-D on the orbiter in 1982, which was a shuttle version IUS with full avionics, but inert solid rocket motors. Next up was IUS-1, which launched Tracking and Data Relay Satellite-A (TDRS) on STS-6, 1983. We interfaced with a variety of Shuttle systems and groups on every mission as well as with Shuttle crew members for training and familiarization of the IUS hardware. There were a total of 15 Shuttle IUS missions that flew at least one mission on each of the 5 orbiters. We flew TDRS A through G, DoD missions, Magellan, Ulysses, Galileo and Chandra … We delayed one launch due to an LRU failure, but changed it out and were ready to go in 24 hours. We worked with people from NASA, the U.S. Air Force and many contractors, suppliers and centers from all over the country. Some we would see on multiple missions, others just once. We had problems and differences with requirements, hardware and schedules, but we worked them out and enjoyed many successful flights. The last Shuttle mission in 1999 was IUS-27 on Columbia/STS-93 which boosted the Chandra X-ray Observatory. I was fortunate to be the IUS-27 test conductor and gave the, 'IUS is go for launch' during countdown three times (2 attempts and one launch). Stellae Trudemus! ('To the stars be true' – from a plaque that hung at the entrance to the IUS cleanroom)."

~ Chuck Broughton, Kennedy Space Center, 20 years with the program

Work Teams & People

"The most significant memory I will take away from working on the Shuttle Program is the awesome people I have worked with while making history! I have been blessed to work with so many sharp engineers who are just as passionate about the Shuttle Program as I am … I have witnessed many amazing accomplishments when the team regularly goes above and beyond what is expected in order to ensure the highest level of mission safety … And an important part of my memory includes working with an amazing customer, United Space Alliance. I could not have asked for a better customer! When the Shuttle Program comes to an end, it will be very hard to see my Shuttle family broken up!"

~ Terry Clark, Houston, 22 years with the program

"Even though we worked many hours, week after week, I enjoyed being a part of the group of engineers that was doing things that had never been done before. I had many memorable experiences, such as coordinating the installation and checkout of the first Ku-Band Comm/Radar on Challenger, and the removal and replacement and retest of the Ku-Band Deployable Assembly with Columbia on the pad, necessary to ensure that the high data could be returned from the STS-9 Spacelab mission … My most memorable experiences was being CNSE in the firing room for the countdown and launch of STS-1 … and my most enjoyable time was spent in designing, coding, debugging and verifying the GOAL software for Orbiter Navies flights and GSE systems. Although I retired from Boeing and the NSLD in 1999, I came back to work as a contract employee for Boeing Depot Engineering where I will end this long enjoyable career."

~ Walter Hollowell, Kennedy Space Center, 34 years with the program

"With employees located in Texas, Florida and California, the Orbiter teams ensure the safe execution of each Space Shuttle mission by providing sustaining engineering, certificate of flight readiness and engineering support to Orbiter operations (including launch), design expertise for vehicle anomaly resolution, engineering for modifications and upgrades to the Orbiters and technical support for hardware failure analysis and root cause investigation. In short, the teams' responsibilities span all Orbiter Vehicle Operations, Design & Requirements and Logistics."

~ John Schindler, Houston, 28 years with the program

"The great Shuttle Program memories I have are working with the teams who worked extensive hours to complete all the required Palmdale work prior to ferry flight to KSC, as well as preparation of the acceptance data package and Orbiter DD250 sell-off to the customer. This effort normally occurred at or after midnight when the last WAD and systems update were completed."

~ Gloria Castellanos, Palmdale, 36 years with the program

"Over the years, my assignment duties have changed many times. The most significant memory and experience working on the Shuttle Program is the realization that the participants have such a huge desire to provide the best possible quality product to ensure a safe launch. Each flight and landing is as exciting as the very first flight and filled with an equal amount of pride and commitment."

~ Rita Casas, Huntington Beach, 23 years with the program

"The Program Integration Engineering team was formed during the transition of the program from Huntington Beach. The team consisted of aero, aero thermal, CFD, loads, stress, acoustics, propulsion, thermal, avionics, electrical and mechanical design, GNC, CM and mass properties disciplines. Less than 20% of the incumbents transferred to Houston. The new team members had to quickly learn all of the processes and procedures while still producing products. Then after the STS-107 accident, the team was the focal point for much of the Return to Flight activities. They were all asked to work 60-70 hour weeks, with countless meetings and reviews, with unending customer attention and direction, all while having to produce quality products on time and error-free. Their efforts are directly responsible for the outstanding performance of the Shuttle since the accident. I hope they all know how important they were to the program."

~ Mike DeVault, Houston, 37 years with the program

"The Shuttle Integration Program consisted of a Systems Engineering & Integration (SE&I) team and a Cargo Integration (CI) team, each responsible for a wide variety of engineering products and services … The SE&I team defined and verified engineering requirements between the elements (Orbiter, ET, SRBs and MLP) including such things as engine ignition overpressure forces, ascent aerodynamic forces and heating, external loads, acoustics, electromagnetic emissions, etc. The team was also responsible for integrated systems performance requirements of the main propulsion system … The Cargo Integration team developed the engineering drawings needed to install payloads in the cargo bay and aft flight deck as well as negotiated and documented interface requirements with domestic and international payload customers … Since cargo integration hardware is installed and removed between each flight bases on mission requirements, this team also performed a logistics function to ensure hardware availability and identify and remedy shortfalls … While the majority of the SE&I and CI teams were located in Huntington Beach and Houston, there was also a team located at Kennedy Space Center. This team provided another level of integration to ground system and cargo processing where all the flight hardware came together. In all, the Integration Program teams have supported every single Shuttle mission from inception through launch and landing."

~ Greg Ray, Houston, 33 years with the program

"I was working in Moscow, Russia, and was invited to the American Embassy to celebrate Independence Day. While I was there, I got talking to a Russian Colonel and it turned out he was Commander Alexei A. Leonov of the Soyuz mission that docked with the Apollo mission commanded by Tom Stafford for the first time on July 17, 1975. I was able to get a picture with both commanders!"

~ Dennis Gardner, Kennedy Space Center, 24 years with the program

"It was a once in a lifetime opportunity to work with many people who gave their greatest personal and technical efforts to planning and executing many successful Shuttle flights. I am grateful to have had the privilege to work with many JSC employees, contractors and my teammates all dedicated to this program. It was great to know that the Shuttle used the algorithms that I designed in the onboard computer for all the flights of this super vehicle."

~ Lawrence (Larry) Guderian, Houston, 25 years with the program

"During a flight software trouble-shooting session in the Shuttle Avionics Integration Lab (SAIL), one of our project managers learned of a fatal error that had been encountered in the Multifunction Electronic Display Subsystem (MEDS) software during 'turnaround' operations in preparation for a SAIL test run. The lab engineers had collaborated in a 'group think' about the cause of the error and insisted on closing the anomaly without further investigation … However, given her in-depth knowledge of the MEDS software, she knew that the test scenario should not have caused a fatal error. So she contacted the MEDS software subsystem manager and technical team in Huntington Beach, supplied them with the specific data captured in the SAIL and assisted the MEDS team as they performed detailed analysis and additional testing. This analysis led to the discovery of a very subtle and rare software error in the new version of the MEDS flight software currently installed and ready for flight. The analysis not only pinpointed the root of the error, but led to a low-risk solution for fixing the problem. Due to the diligence of a single employee, a software error was caught and corrected that would have otherwise remained undetected during the STS-128 flight! And for these extraordinary efforts, Debra Owen received the Spirit of Cook award from the Boeing Space Shuttle Program Manager!"

~ Doug Corbin, Houston, 20 years with the program

"I started in the Rockwell Downey facility just as PCs were being introduced into the office environment and will never forget the Apollo legacy guys that thought these new-fangled machines were just a fad. They would tell me, 'We got to the moon with slide rules and graph paper, what do we need these things for?' We created Rollout Review and FRR briefings with hand-drawn pictures, press-on letters, tape and scissors – oh, how the world has changed! The culmination of our hours of mission planning and readiness reviews was to sit in awe and watch each and every launch. We really couldn't even talk until MECO, which caused a collective sigh and then cheering in the room. We monitored the missions, worked issues as they developed and then the cycle would repeat again on landing day – what a relief to see the nose gear touch down! I feel so fortunate to have been a part of this historic program and to have been able to share the journey with my Shuttle family."

~ Laura Turner, Houston, 23 years with the program

"To have lived and been a part of the extraordinarily talented and knowledgeable team of individuals who developed the Space Shuttle System and Orbiter Vehicle has certainly been a blessing. The NASA and contractor Shuttle team is perhaps the greatest collection of management and technical capability ever assembled."

~ Gary Mauss, Downey, 27 years with the program

"It's been my good fortune to work with the Boeing Program Integration team since the beginning of the Space Shuttle Program. The technical achievements of this group of engineers are numerous. One of the most significant is the development of the Day of Launch I-Load Update (DOLILU) process. Before there was an STS-1, there was DOLILU. Before there was a completed Shuttle design certification, there was DOLILU. The Program Integration team at Boeing was ahead of its time … The team's experience and expertise recognized that ambitious Shuttle flight operations would require implementation of unique capabilities in the ascent flight design … While the specific design and implementation of the current DOLILU process is unique to the Space Shuttle vehicle application, its requirements and process components are applicable to any future human-rated launch system … During my career, it has been a privilege to be both a customer of the Boeing Program Integration team and a member of it. The sense of purpose and dedication brought by this team to the challenges of our human spaceflight endeavors has made me proud of our association."

~ Lambert Austin, Jr., Houston, 44 years with the program

"The most significant memory I have is of all the great people. I was fortunate to have worked with and been mentored by folks who built NASA and the space program into what it is today. As for my participation, I was one of three people in the MER to support the first Orbiter Approach and Landing Test. Our team provided near real-time thermal analysis support to STS-51A, which had never been attempted due to computer turnaround time, in order to ensure the hydrazine on the satellites would not freeze … I've also had the pleasure of managing several outstanding teams during my years on the program. All of these teams had the same reasons for being successful – outstanding technical knowledge with a drive to always perform at their best, great people who loved manned space flight and who enjoyed working as a team. Two in particular stand out … the Shuttle Thermal Systems Team and the Program Integration Engineering Team."

~ Mike DeVault, Houston, 37 years with the program

"My memories of the Shuttle Program are about how much the whole team becomes a part of your family. We laughed together, cried together, prayed together every time the Shuttle went up or came down. We shared the good and the bad, the happy and the sad and everything else that friends and family share. The Shuttle has brought nations together to share ideas and wisdom and everyone has worked together toward one goal and we've made it! There has never been another program that extended its wings out to so many people … And who would have ever thought that a girl who went to a one-room schoolhouse in Chelsea, New York, would ever become part of history? I am so very proud of being an American and working on this fabulous program!"

~ Sandra Klotz, Kennedy Space Center, 23 years with the program

"My first official day on the Space Shuttle Program was May 17, 1982, when I was hired by Rockwell International as a TPS engineer. The stack for STS-4 was rolled to the pad that same week. Little did I know at the time of the amazing journey I was on. I have been very fortunate to have spent my entire career as a member of the Space Shuttle team. I have been blessed to meet and work with so many very talented and great people from all over the country all these years … we have tackled some very difficult technical issues and we should all take great pride in having been able to contribute to overcoming those issues and the overall success of the program …"

~ Lee Griesemer, Kennedy Space Center, 29 years with the program

"One of my most memorable moments occurred during the STS-122 mission. As the Astronauts installed the European Columbus module, I felt that my work with the space program came full circle. Prior to joining the Shuttle team, I worked as an engineer in Europe supporting ESA's work on the Columbus Laboratory. I joined Boeing later in 2001. Over the past ten years, I've worked with the Ascent GN&C group supporting system integration and flight operations. It's always a thrill to work a mission, but it was especially gratifying to have supported the STS-122 mission and to see the work on the Columbus Laboratory come to fruition … It's just a very rewarding feeling!"

~ Lia Tusanotte-Cisnero, Houston, 10 years with the program

"The STS-107 Columbia accident and the investigation that followed resulted in NASA's realization that the safety of the Astronaut crews on subsequent missions demanded that design changes be made to the flight hardware before returning to flight. A particular requirement was an inspection boom with surface scanning instruments that could be used by the on-board crew to examine the entire Orbiter outer surface for any imperfection that could cause an issue during entry heating. This daunting task, which required working with suppliers in Canada, using existing electromechanical actuator designs in new applications, integrating tests, and analyzing and certifying hardware in a high-pressure, return-to-flight environment, was accomplished not only under budget, but ahead of schedule. From go-ahead to launch was less than 18 months, an unheard of accomplishment for human spaceflight hardware. But the Boeing team delivered, and the newly designed hardware performed flawlessly on STS-114, Discovery's Return to Flight mission."

~ Dwight Woolhouse, Huntington Beach, 39 years with the program

"I joined the Shuttle team during the first Return to Flight activities after Challenger. We redesigned the ascent profile for STS-26 eight different times before the final design was decided upon. The landing was at Edwards and a group of us made the drive up from Downey. It was quite a sight and attended by more than 200,000 people … I'll most remember the incredible people I met on this program – the Apollo legacy folks who were so patient with us and liked to call us 'kids,' the friends and co-workers who worked to enhance the vehicle with small and large upgrades and debated how to solve the tough problems. I grew up in this program in many ways. I learned life's lessons, even the tough ones … But participating in the Space Shuttle Program for this long IS the most significant experience and one of the best things I have ever done in my life. I know that someday this will seem like just a chapter or two, but I can't yet picture anything that will ever be as rewarding."

~ Bruce Fiske, Houston, 20 years with the program

"The ultimate highlight of my memories through the years is of being a member of the Space Shuttle team and supporting operations from planning OPF activities to 'T-minus-0' in the Firing Room for the many successful lift-offs and missions …"

~ Monique Butler, Kennedy Space Center, 25 years with the program

"My undergraduate major was Aerospace Engineering and, as such, my career goal was to work on the Space Shuttle Program. I worked for McDonnell Douglas for four years before transferring to Rockwell International to work on the Shuttle. I have enjoyed the many opportunities that Boeing has afforded me, including job rotation assignments and the opportunity to get an advanced degree. I have been a project engineer for many years because I enjoy not only the engineering and project management aspects of the job, but I really enjoy interacting with so many wonderful people on a daily basis … Highlights of my career have included working at the NBL, working in the SAIL and giving the 'go for launch' for Reconfiguration Engineering from the Mission Control Center … When I toured KSC, I felt like I was on top of the world. After working on the engineering side of the business for so many years, it was a once in a lifetime opportunity to see the actual flight hardware. We were treated to a tour of the OPF, the VAB and the pad … While it is sad to see the program come to an end, it is a time for new challenges and adventures!"

~Natalie Tolliver, Houston, 29 years with the program

" … Along the way, I learned and worked alongside many remarkable and talented people comprised of contractors, NASA and some of the pioneers of the Russian Space Program. However, the most memorable experience has to be the STS-1 launch because I participated in test and analysis programs that helped certify the Orbiter's wing leading edge, nose cap and TPS for flight and entry. In doing this, I worked in some amazing test facilities – the 10-million-watt plasma arc jet and the 10-million-watt radiant heat facility. The successful STS-1 mission became the culmination and affirmation of all the work the team strove to accomplish … Nowadays, I'm proudly associated with two accomplished teams – the On-orbit Passive Thermal Analysis Team and the Ascent and Entry Thermal Protection Analysis Team – that continually exhibit a towering sense of professionalism and dedication to safe flight and successful missions … Come STS-135, I will have worked on the Shuttle Program from cradle to grave. Working in human space exploration is a childhood dream come true and I feel extremely privileged to have participated in one of our nation's greatest endeavors!"

~ JJ Gallegos, Houston, 37 years with the program

"The Shuttle Thermal System Team was responsible for ECLSS, active and passive analysis of the Orbiter and payloads, as well as the design, analysis and testing of the TPS and RCC. In the '80s and '90s this team was considered by both Boeing and NASA as a 'Center of Excellence' and were often asked to assist in solving the difficult thermal issues. For STS-51A, they developed a process for doing real-time integrated analysis in support of Mission Control … the ECLSS and Orbiter TCS teams resolved countless critical safety in-flight issues that were always needed as soon as possible and always received extra management oversight. Their flawless performance under pressure was a credit to their dedication and abilities."

~ Mike DeVault, Houston, 37 years with the program

"Bye-bye, Shuttle team, after 30 years of spaceflight achievements and the embodiment of 20th century scientific evolution. Such an amazing and complex vehicle that lifts off into space, orbits the Earth and returns. We'll miss the Space Shuttle when it retires."

~ Wei-Joe (Wei) Sun, Houston, 16 years with the program

"My memory is the people. I had mentors that helped me develop and I had good people that I worked with and who worked for me. Working on the proposal team for OV-105, Endeavour, was very demanding but very memorable for me."

~ Alvin Beckner, Houston, 43 years with the program

"Working on the Space Shuttle has always been more than just a job. It has been a way of life. I feel very blessed to have contributed to such a wonderful program and to have worked with such fabulous people. In our organization, I always saw people treated with the utmost respect. We have a poster on the wall here in Huntington Beach that has a quote from Dr. Seuss underneath a photo of a Shuttle liftoff. It says, 'Don't cry because it's over. Smile because it happened.' That's how I feel about the Space Shuttle Program."

~ Tino Rishmawy, Huntington Beach, 31 years with the program

"Being part of the CEIT celebrations held for each launch somewhere near KSC … Drinking beer and telling stories with 'Hoot' Gibson and Charlie Precourt at Cocoa Beach Country Club … Many memories of many Astronaut handshakes, signatures and discussions (about how their lives were in the Shuttle workforce's hands) were obtained at these celebrations. What an honor it was to work on this American Space Shuttle Program!"

~ Bryon Loveland, Kennedy Space Center, 30 years with the program

My Memories

My Memories

"... Don't cry because it's over.
Smile because it happened.
That's how I feel about
the Space Shuttle Program."

And so do we all.

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TOW
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