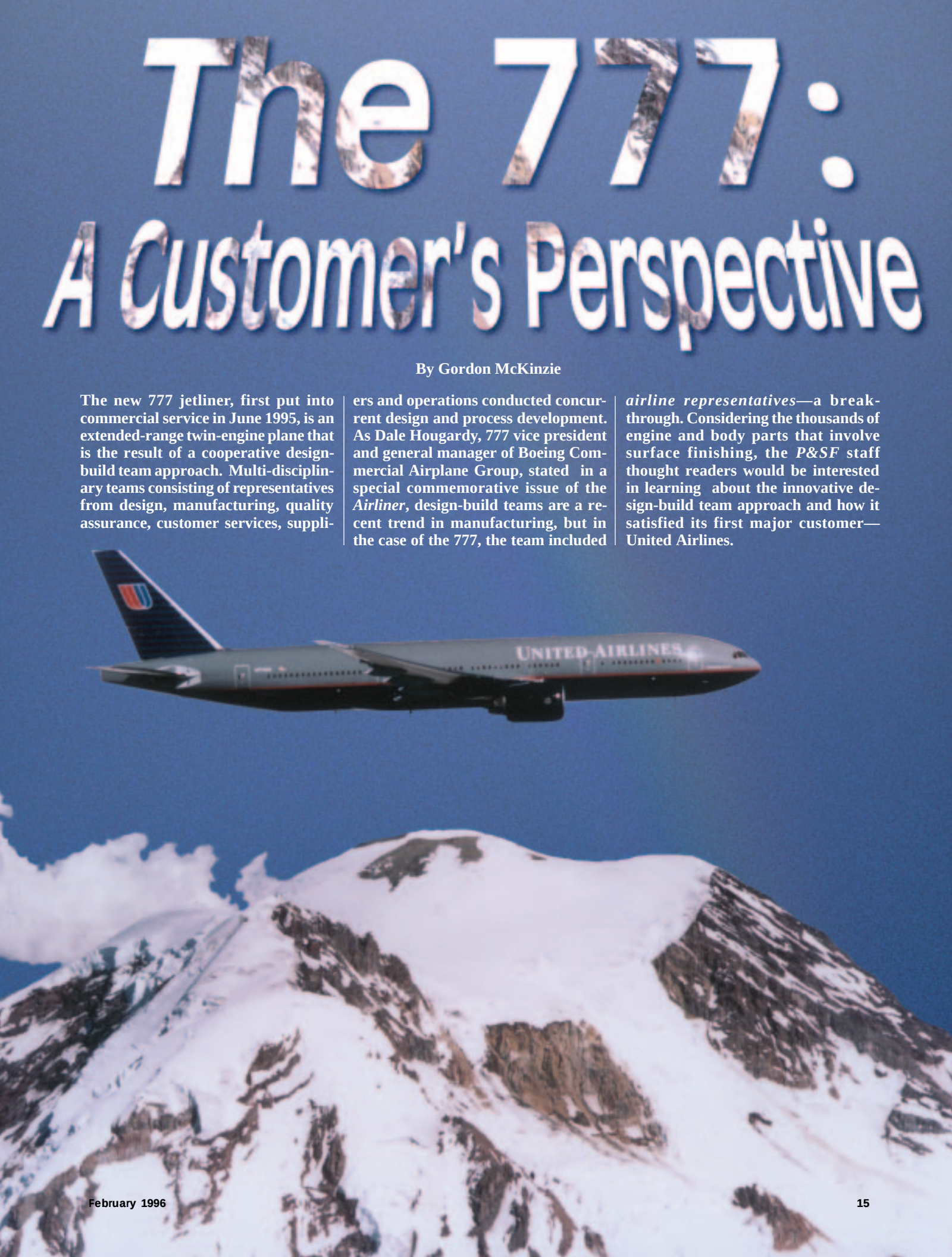
The 777: A Customer's Perspective

By Gordon McKinzie

The new 777 jetliner, first put into commercial service in June 1995, is an extended-range twin-engine plane that is the result of a cooperative design-build team approach. Multi-disciplinary teams consisting of representatives from design, manufacturing, quality assurance, customer services, suppliers and operations conducted concurrent design and process development. As Dale Hougardy, 777 vice president and general manager of Boeing Commercial Airplane Group, stated in a special commemorative issue of the *Airliner*, design-build teams are a recent trend in manufacturing, but in the case of the 777, the team included *airline representatives*—a breakthrough. Considering the thousands of engine and body parts that involve surface finishing, the *P&SF* staff thought readers would be interested in learning about the innovative design-build team approach and how it satisfied its first major customer—United Airlines.



What better perspective to have at hand for recalling the amazing journey United Airlines has just completed with Boeing in "Working Together" on the development of this beautiful airplane! As I write this, I'm sitting comfortably in seat 23A and viewing things as one of our revenue passengers will be able to do.

I am on the airplane today as an "essential" passenger, helping with our 90-flight Early ETOPS (extended-range twin-engine operations) validation exercise. But I'm having no difficulty imagining the total awe and pleasure the flying public will have when it is treated to this product of so many minds, hands, and energies between Boeing and the numerous customers invited to participate in this experience.

The 777 will truly be the *renaissance airplane* for the airline industry. For the first time in the evolution of airplanes and the people who build and fly them, traditions have crumbled, mindsets have altered, visions have unclouded, and totally new cultures have emerged. This has all happened in the course of putting an unprecedented focus and concern on assuring that by Working Together, we could create a product that Boeing would want to build and we would want to fly.

The Past May Not Be The Best Prologue

As strange as it may seem, this obvious approach to product excellence hasn't always been mutually acknowledged by our two companies. The processes associated with past programs have always been very predictable: The airline customer would pore through the brochures, attend endless briefings, elegant dinners, (maybe even an occasional fishing trip), then see his configuration of choice crafted in a two-inch-thick specification document that would tell him everything he "needed to know" about the new airplane.

The rest was simple: Wait approximately four years (while making occasional progress payments to Boeing to show we were still interested), then meet the airplane as it rolled out of the factory. Along with this event, of course, was the expectation that everything we had asked for was always included. As a general rule, the process worked very well. Over the years, we have seen Boeing airplanes added to our fleet inventory in this very same fashion more than 940 times.

But with the 777 program, something remarkable happened between Boeing and its customers that will forever change the manner in which we design and build airplanes in the future. And, walking nose-to-tail in WA004 and taking in the many attributes of this great airplane is proof that, from *our* customer's perspective, we've *done good*!

So Show Me!

My first exposure to the 777 was as a result of a "put-your-money-where-your-mouth-is" challenge to Boeing. In 1989, as Manager of New Technology Engineering for United Airlines in San Francisco, I was heading a study that was looking with great interest at the emergence of a widebody twin being developed in Europe. (Actually, the design was more than emerging; *metal* was about to be cut!) When Boeing began telling us they were "well along" in looking at the same type of large two-engine airplane with a passenger capacity similar to a DC-10, I suggested they were trying to steer us away from looking at the competition. "If you are serious," I said to Boeing, *"then show me!"*

Zap! Before I could say "flaperon," a long arm reached down from Seattle and nudged me 20 miles south into the NASA Ames Transonic Wind Tunnel, where on-site Boeing engineers Jerry Lundry and Mark Goldhammer showed me the new airfoil shape they were testing for the "real" 767-X (soon to become the 777). Seeing was believing. (Memo to Jerry and Mark: That wing design turned out to be a real winner. We're now cruising WA004 at a Long Range Cruise of Mach .842, considerably faster than advertised.)

The "Gang of Eight"

In early 1990, long before any airline had been seriously courted as a potential buyer for the then-767-X,

In the past, customer involvement in new airplane acquisition consisted mainly of waiting for "delivery day." On this day, the customer usually gave Boeing a final payment in return for the keys to the airplane.

In May 1989, the author (right) gets his first look at the 777—in the NASA Ames Transonic Wind Tunnel. At left is Jerry Lundry of Boeing Aerodynamics.

Boeing instigated a series of "Ask the Customer" meetings. It was a first step to involve us in letting our preferences be known regarding new aircraft design. Participants included major United States domestic, Asian, and European carriers, soon branded as the "Gang of Eight." The Gang found itself invited, on three separate occasions, to participate in two-day sessions (in relative confinement) with principal Boeing engineers.

While we were taken through the various design elements of Boeing's approach to a new widebody twin, there were no constraints on what we could — and did — tell our hosts. Much to the chagrin of our hosts, we wouldn't always have consensus on a design issue (what Boeing didn't know is that we worked out most of our differences and reached common understandings in the mini-bus rides back to our hotel).

Some design issues emerged from the Gang of Eight with very little coaxing: In the flight deck, we wanted a front office patterned after the 747-400 (*not* the 767, as originally pitched by Boeing), fly-by-wire, electronic checklists, wide-paper printers, flat panel displays, and *quieter* windshield wipers.

Moving into the cabin, we made a case for interactive video, overhead centerline bins that translated out toward the aisle, a wider fuselage than the competition so seat bottoms could be wider, flexible zones for easier configuration modifications, reading lights that could be relamped in flight, improved ventilation, shorter cabin air exchange times, and *flat floors.*

On the maintenance side, we touted the benefits of improved BITE (Built-In Test Equipment), a maintenance access terminal in the flight deck (with auxiliary ports throughout the airplane), and better sensor electronics and devices in all systems to reduce the incidence of false warnings.

And yes, we had our share of the more creative discussions that involved issues such as sidestick controllers, laptop keyboards for the pilots, external video cameras, and fueling receptacles in the nose gear strut. Everybody had a voice, and the net effect was a remarkable consortium of ideas and strategies that poised the 767-X for a great future as the "customer-preferred" airplane.

But the process didn't stop there, as it might easily have done. As potential customers, we were impressed with the intensity and candor of the Gang of Eight sessions, and while we fervently hoped that our comments would be taken seriously, we at United Airlines had no clue that the most significant aspect of Working Together was about to happen.

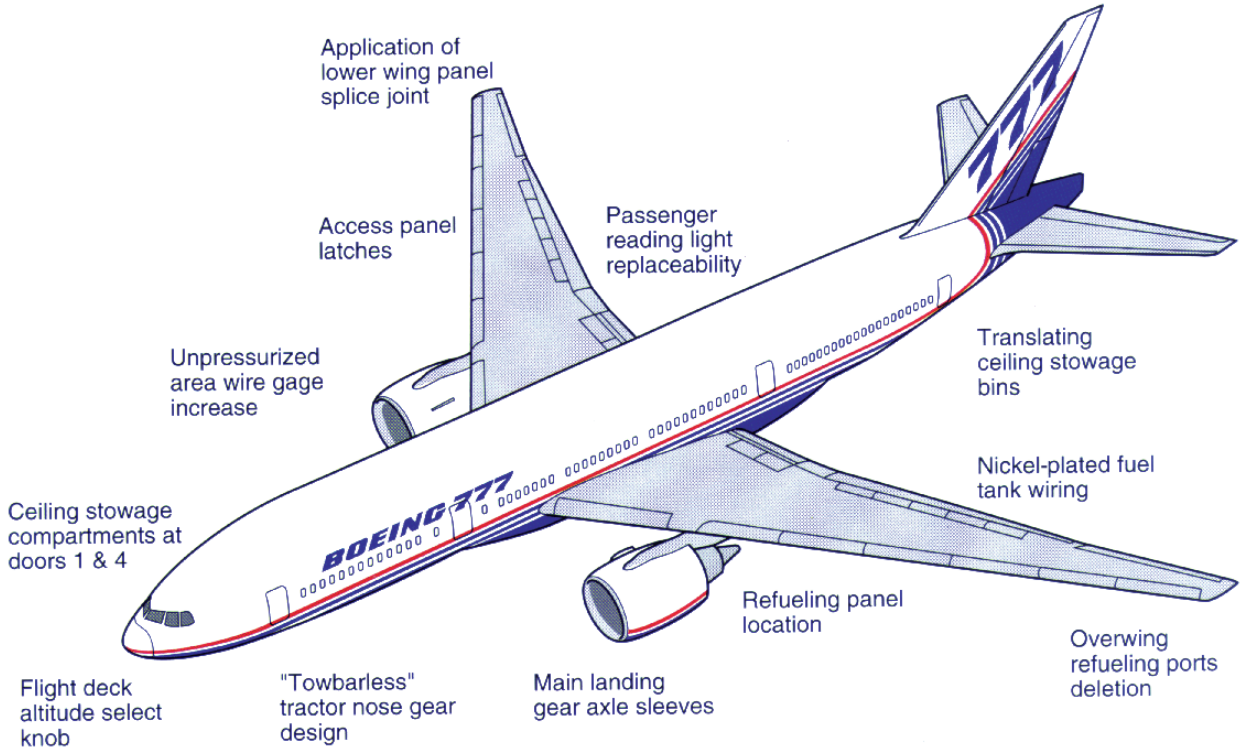
You're Here to do What?

On the day United decided to purchase the 767-X, Jim Guyette, our Executive Vice President of Operations (now retired), shared a vision with a few of us who were engaged in the 70-hour marathon negotiating session for United's next widebody transport. Jim recalled some of the difficulties we had endured in our most recent new aircraft acquisition programs: "We've just gone and signed up for another Boeing airplane. How can we make sure that this airplane will be the best thing we've ever done?" he said. "How can we tell Boeing what's *really* important to us, so that we never have to repeat the problems of the past? Most importantly, if we don't change the process *now*, we could very likely be spending our days anguishing over why we couldn't have made this next airplane the best airplane we would ever fly."

What evolved was a simple set of guidelines entitled "B777 Objectives" which would set the tone for Working Together between our two companies. This simple, one-page agreement on a yellow legal tablet set the tone for the entire 777 program. The memo was handwritten by Jim and signed by Boeing's Phil Condit (then head of their New Airplane Program, and now President of The Boeing Company) and Dick Albrecht (Executive Vice President, Boeing Commercial Airplane Group). The agreement outlined the principles that launched, and have sustained, our amazing journey these past five years. It simply described an airplane that would offer, from day one:

- The greatest dispatch reliability in the industry.
- The greatest passenger appeal in the industry.
- An airplane that is *user friendly* and *where everything works*.

With these simple but powerful words, the journey began. The next thing we did to reinforce the new arrangement was to literally *infiltrate* the Boeing design process, at all levels. While this may have seemed like an easy and obvious move to make, it was probably the first true "culture clash" the



Shown are some examples of the more than 300 design inputs contributed from the Working Together airlines to the overall design of the Boeing 777.

program would encounter and work through. Showing up at a Design-Build Team (DBT) meeting as a customer was, at first, about as awkward as wandering into the wrong locker room. More than once, there would be reactions from Boeing DBT members that were something like this: "You're here to do *what*?" Before long, however, the input of the four Working Together airlines became such a familiar and comfortable element of the design evolution that DBT meetings would often wait until the customer representative arrived. In many cases, the airline feedback would be purely anecdotal, but the intent was always the same: To impress on the Boeing designers and developers that the seven "ables" (affordable, certifiable, durable, maintainable, reliable, removable, repairable) had to make their appearance in every aspect of the design and build.

The engineers didn't always appreciate us, referring to the "Fisher-Price" build concept (like Fisher-Price toys, it comes apart and goes back together easily). But the message nevertheless became firmly embedded as a key initiative as the design activity moved forward. The drawing above shows some of the more publicized airline inputs.

Looking at the airplane today, we see how the Working Together team has held to that commitment. Later design inputs included ceiling storage compartments at Doors 1 and 4, relocated fuel control panels, landing gear truck over-temperature indicators, and skin splice sealing. The airplane design continued to evolve along lines that totally incorporated the broadest possible range of customer-sensitive issues that could be anticipated for the new airplane.

Training, Training, Training

In a manner similar to the one being employed in the design process, the support products for the airplane also began to grow and nurture in direct response to customer involvement. In the development of training courseware, for instance, we assigned a cadre of maintenance and flight training specialists to sit side by side with Boeing developers. Their long and meticulous assignment was to convey the familiarity and functionality of the new systems in ways that reflected the idiosyncrasies and characteristics of the users. (This process is described in the January-March 1995 issue of *Airliner*, in an article entitled "777 Maintenance Training.")

This momentum soon carried over into manuals, parts catalogs, provisioning lists, and the many other documents, data tapes, instructional tapes, and videos that constitute a new fleet acquisition. On more than one occasion, United's maintenance trainers would find eager new students in the form of Boeing courseware developers who had been invited to view the maintenance world of an airplane through a line mechanic's eyes.

The benefit of those sessions was key to a primary objective we shared: Build the training programs just *once*, and for all to use, without the dissimilarities of the past that involved unnecessary duplication of the material to make it *airline-like.* As we work today with the results of this amazingly obvious, but nevertheless evolutionary accomplishment, we can already begin to see the savings that will accrue to both manufacturer and customer.

Service-Ready: More Than Just a Buzzword In the Brochure

And now the final leg of our joint development journey is well under way. As I write this, we are flying WA004 through 90 United flight segments to demonstrate to the FAA that our procedures and processes to maintain the airplane according to ETOPS criteria are equivalent to two years' of experience and maturity with the airplane.

Five years ago, we put forth the idea that we could validate the experience

of two years' worth of flying in one month, and that a total of 1,000 flight cycles between us and Boeing could be consistently flown with virtually no disruptions and a high degree of reliability. With this idea, we put our commitment of five years' worth of collaborative design, development, and planning on the line.

When WA004 launched into its 1,000 Cycle ETOPS Validation Program, it did so with virtually all design issues, test objectives, and support mechanisms totally developed and in place. The fact that we are flying the airplane in simulated airline service and interfacing with standard airline systems *two months* before we are scheduled to start revenue service is in itself a bold statement that speaks to the readiness of the design and the support products involved.

In for the Long Haul

As the 777 family plan emerges through the years, we will be building on a baseline design of engineering, styling, and functionality that will be with us for the next 60 years as we move through the derivatives of the longer range and stretch models of the airplane. It was important, then, that the core of the airplane contained a robustness of design, customer preference, and demonstrated quality that would survive the decades ahead.

Our perception is that the 777 will be the most successful airplane United Airlines has ever put into service. That's a pretty bold statement, but the proof is all around me as WA004 begins its let-down over Diamond Head and approach to Honolulu — with only the APU generator providing total ship's power, per the FAA's request.
Aloha!

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About the Author

Gordon McKinzie is the 777 program manager for United Airlines. "Working Together" was the hallmark of the 777 program, and McKinzie powered up his laptop computer in April 1995 during a 10 1/2-hour 777 ETOPS (extended-range twin-engine operations) validation flight from Washington, DC to Honolulu, Hawaii, and shared his thoughts on the "Working Together" concept from the customer's viewpoint.

Additional Reading

The July-September 1995 issue of the *Airliner*, from which this article was taken, is specifically dedicated to the 777. Other articles from this issue that may interest readers include: "777 Certification;" "ETOPS Validation at 1,000 Cycles;" "Human Engineering of the 777 Flat Panel Displays;" "777 Composites;" and "777 Full-Scale Static and Fatigue Structural Tests."

The April-June 1995 issue features articles on 777 flight deck design and a pilot's perspective on flying the 777.

The July-September 1994 issue contains a detailed article on the design considerations, innovations, materials and finishes in the 777 engines (the PW4084, the GE90, and the Rolls-Royce Trent 800).