Destination RNP

AUTOMATION EVOLUTION
TRANSFORMING SOUTHWEST

ALL RNP INFORMATION CAN BE FOUND ON **SWALIFE** UNDER FLIGHT OPS>RNP

CAPTAIN CHUCK MAGILL
VICE PRESIDENT FLIGHT OPERATIONS

SOUTHWEST AIRLINES AND RNP – PREPARING TO ENTER THE NEXT GENERATION OF COMMERCIAL AVIATION TECHNOLOGY

We are indeed entering one of the most exciting times in the history of our airline. We are in the final stages of our journey to realize the Next Generation of aviation technology—RNP.

RNP is a cornerstone in the future of the National Airspace System. The FAA's NextGen plan is a wide-ranging transformation of the entire air transportation system to meet future demands. NextGen advances us from ground-based surveillance and navigation to a new and more dynamic satellite-based system. The new capabilities and the advanced technologies that support them will change the way the airspace system operates. RNP and the FAA's NextGen airspace transformation will reduce congestion, shorten route structures, and improve the Passenger experience.

You're about to begin RNP Training Steps 2, 3, and 4, which will get us to our ultimate goal of flying RNP and GPS procedures. You will see an absolutely phenomenal training product, which is like nothing you have ever seen at Southwest before. This "hands on" training will guide you in unlocking the true potential of our aircraft and prepare you to fly the next generation in commercial aviation technology.

As we enter this final push to realize RNP through the next three training steps you need to come prepared and have a working knowledge of procedures learned in Step 1 Training. You will need to be open minded to new learning as we adapt and incorporate new state-of-the-art technology into our operation.

Countless hours have been devoted with an unmatched collaborative effort across nearly every department at Southwest Airlines—all with the goal to make us true industry leaders in NextGen technology and procedures. I want to personally thank and acknowledge the many individuals in Flight Operations who have gotten us to this point. This is a huge undertaking and required much personal sacrifice to get the job done, and I want you to know your efforts have not gone unnoticed. I am proud to be a member of this Team and to be a Pilot at Southwest Airlines during this automation transformation.

This is an exciting time for many of us as we learn new simplified procedures which will reduce our workload, improve our situational awareness, and enhance our Safety. We must embrace this technology to compete and operate in the NextGen airspace. Good luck with your training. We're almost there; thanks for your efforts, for your professionalism, and for your dedication to RNP.

"Southwest Airlines has taken the lead in our industry with our previously-announced commitment to Next Generation navigation techniques known as RNP. With higher energy costs, we need a commitment to the Next Generation of technology to continue to reduce fuel consumption, costs, and emissions,"

remarked Chairman, President, and CEO Gary Kelly at this year's Annual Shareholders Meeting

RNP FACTOID: Track Mile Savings

Did you know, for each mile you save, you...

save **12.25 seconds** of flight time.
save **29.3 pounds** of fuel.
eliminate **91.9 pounds** of CO2.
eliminate **.34 pounds** of NOx.

WHAT IS NEXTGEN?

How do we take the current departure, enroute, arrival, and squeeze more aircraft into a smaller space doing it safely and more efficiently? The FAA's Next Generation National Airspace System (NextGen) is the plan to modernize the national airspace system. NextGen addresses the impact of air traffic growth by increasing the airspace's capacity and efficiency while simultaneously improving Safety, reducing environmental impacts, and increasing user access to the airspace system. To achieve this, the FAA is implementing Performance-Based Navigation (PBN) routes and procedures.

WHAT IS THE FAA TIMEFRAME FOR IMPLEMENTATION OF NEXTGEN?

NextGen implementation falls into three timeframes: near term (2006-2010), mid term (2011-2015), and far term (2016-2025). Initiatives in the near term focus on realizing the value of investments by operators, like Southwest Airlines' investment of $175 million, as well as FAA investments in satellite-based navigation and conventional navigational infrastructure. Key components of the near term objective is wide-scale RNAV implementation and the introduction of RNP for enroute, terminal, and approach procedures. The mid term objective is centered on shifting to predominantly RNP operations for improving flight efficiency and airport access. The far term initiative concentrates on PBN in the NextGen Airspace through integrated RNP and automation enhancements.

WHAT IS PERFORMANCE-BASED NAVIGATION?

PBN is a framework for defining performance requirements in navigation specifications. It can be applied to an air traffic route, instrument procedure, or defined airspace. PBN provides a basis for the design and implementation of automated flight paths as well as for airspace design and obstacle clearance.

The two main components of PBN are Area Navigation (RNAV) and Required Navigation Performance (RNP). RNAV specifies the routes, while RNP specifies the performance criteria.

RNAV AND RNP

WHAT IS RNAV?

RNAV enables aircraft to fly on any desired flight path within the coverage of ground- or spaced-based navigation aids, within the limits of the capability of the self-contained systems, or a combination of both capabilities. Simply stated, RNAV aircraft have better access and flexibility for point-to-point operations.

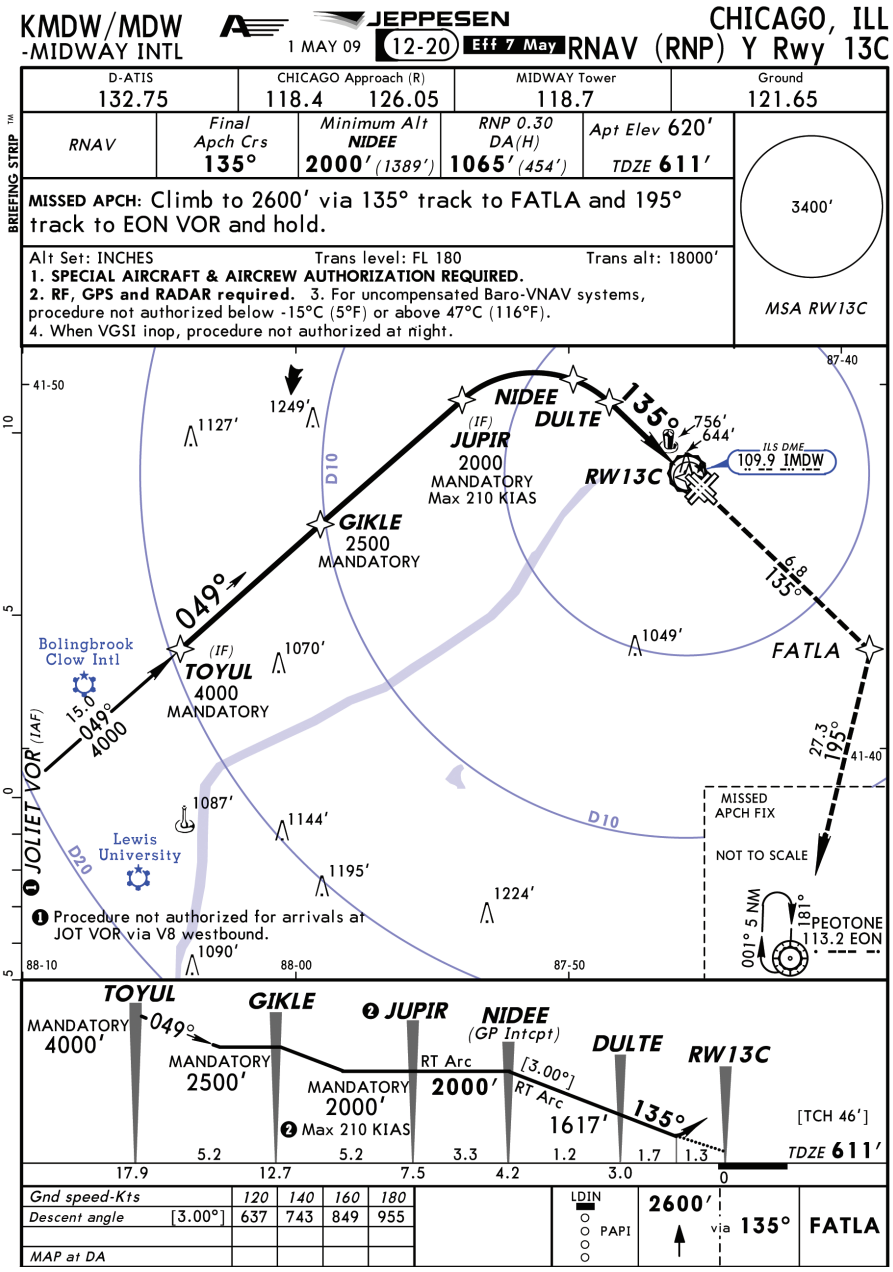
WHAT IS RNP?

RNP is RNAV with the addition of onboard performance monitoring and alerting. An RNP operation provides the ability of the aircraft navigation system to monitor the navigation performance of the aircraft and, in turn, inform the Crew if the requirement is not being met. This onboard monitoring and alerting capability enhances the Crew's situational awareness and can enable reduced obstacle clearance or closer route spacing without intervention by Air Traffic Control.

HOW IS RNP DIFFERENT FROM RNAV?

Although RNP and RNAV both involve preprogrammed FMS procedures, they have many key differences:

- Enhanced RNP requires GPS; RNAV can be conducted with or without GPS.
- Aircraft performing RNP operations continuously monitor aircraft navigation capabilities (navigation performance). If navigation performance falls below minimum specified values, Pilots are alerted (*e.g.*, UNABLE READ NAV PERF-RNP).
- RNP offers curved paths called Radius to Fix (RF) legs. Traditional RNAV course changes utilize Track to Fix (TF), which stitch together straight-lines. For example, if a course change is required on a traditional RNAV procedure, the procedure simply connects the two segments associated with that course change. The radius of turn depends upon the degree of course change and ground speed of the aircraft. The result is a varied ground track based on groundspeed. On the contrary, an RNP procedure can use an RF leg for course change, which defines a radius to be flown regardless of groundspeed. The end result is a consistent ground track that is independent of aircraft type.
- The combination of GPS monitoring and alerting allows RNP users to navigate around obstacles, other traffic, and/or environmentally-sensitive areas where current ground-based navaid procedures cannot.
- The actual path flown by RNP aircraft follows a predetermined path with an accuracy measured in feet. Ground tracks on RNAV aircraft can vary significantly, and the Crew is typically unaware of any navigation error. The precision accuracy of RNP provides an added level of Safety, which is unmatched by traditional navigation capabilities.



MIKE VAN DE VEN
CHIEF OPERATING OFFICER

It is stated in the Introduction of the Southwest Airlines *Flight Operations Manual* that "The most important Flight Operations/Flight Dispatch decision-making priority is safety. No priority at Southwest Airlines takes precedence over the well being of our People, Customers, and equipment." Our next priority is service, and following service is efficiency. Each time we consider a change at Southwest, we ask ourselves if the change is consistent with these three priorities. In the end, whatever the driving force for a change might be, we always consider Safety first.

Strict adherence to these operational priorities has been the foundation of our success. We have one of the best Safety records in the industry; we're consistently praised for our superior service; and our efficiency provides the necessary cost advantage to help us compete in a savage market plagued by variables beyond our control. In order to continue down our path of success and remain a strong Company, we must continually strive to improve.

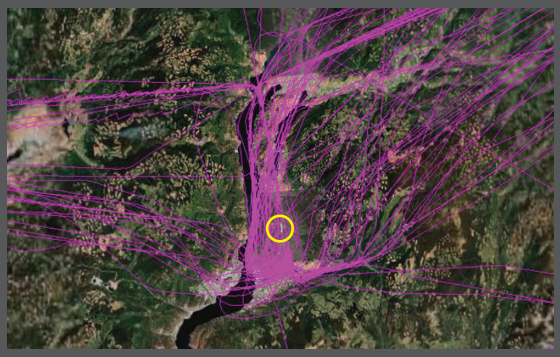
It's not often that a new technology or procedure can offer large-scale, positive contributions to each of our operational priorities. But, this is precisely the case with Required Navigation Performance (RNP). RNP takes Safety to the next level and also offers increased dependability (service) and efficiency—a virtual home run. Considering the current state of our industry, improving all of our operational foundations is more important now than ever before.

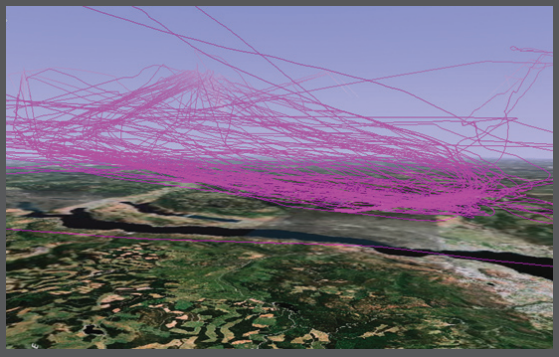
We have accepted the FAA's "call to action" to implement Performance-Based Navigation. In support of the joint government/industry strategy referenced in the FAA's Roadmap for Performance-Based Navigation, we've made a significant financial commitment.

Bringing together the accuracy of Global Positioning System (GPS); the capabilities of advanced aircraft avionics; and new flight procedures, RNP will achieve safer, more efficient, and environmentally-friendly flight operations. Transitioning to RNP will be a monumental initiative for our Company. We've made a Corporate commitment to support RNP and require your commitment in order to achieve success.

RNP is the cornerstone of the FAA's Next Generation (NexGen) Airspace. We could ignore what's to come and simply wait until tomorrow is upon us. Instead, we are committed to being industry Leaders and capitalizing on the benefits of this technology. We will truly be Leaders in this initiative and the eyes of the world are upon us. Thank you in advance for your hard work and commitment to success.

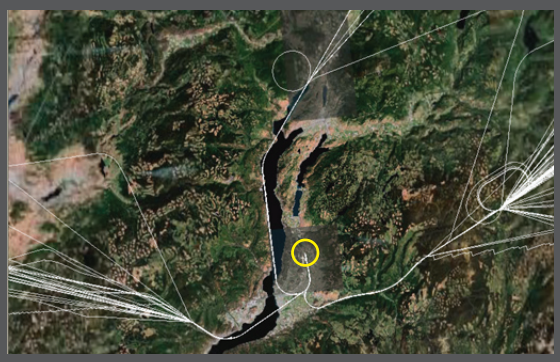
NON-RNP PATHS





The graphics above show actual non-RNP flight paths from an overhead view (left) and vertical profile (right). The airport is represented by the yellow circle.

RNP PATHS



The graphics above show actual RNP flight paths from an overhead view (left) and vertical profile (right). The airport is represented by the yellow circle. The inbound paths from the east result in a 31 NM reduction in miles flown. Paths from the west result in a 41 NM reduction. Notice the consistent and precise tracks in both perspectives.

THE TRANSFORMATION CONTINUES

Southwest successfully completes a demo flight, flying RNP procedures roundtrip between DAL and HOU on March 8, 2009

Our RNP OpSpecs are submitted to the FAA on January 23, 2009

RNP Step 2 Training (a paid, online proficiency course) begins in July 2009. All Pilots will complete this training by September 2009

DAL/HOU RNP path should be ready

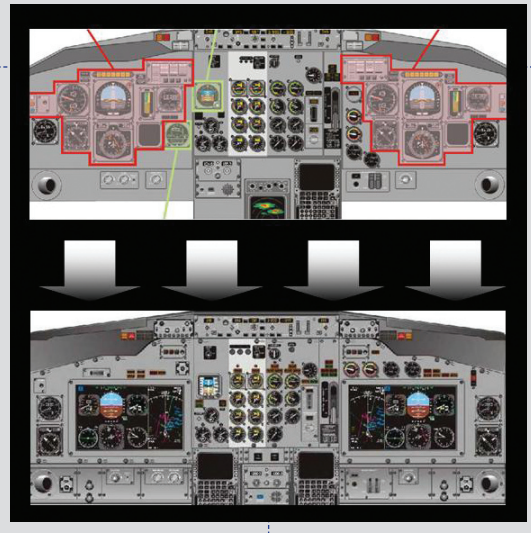
DEC 2008 | **JAN 2009** | **MAR 2009** | **JUN 2009** | **JUL 2009** | **AUG 2009** | **SEP 2009** | **JAN 2010** | **MAR 2010**

All Pilots successfully completed RNP Step 1 Training in December 2008

Autothrottles and VNAV are activated on equipped NG aircraft and approved for use above 10,000 feet on January 13, 2009

All NG aircraft are projected to be autothrottle and VNAV capable by July 2009

RNP Step 3 Training (a paid ground school and simulator event) will begin in September 2009. All Pilots will complete this training by April 2010



RNP Step 4 Training (a paid ground school and simulator event) begins in April 2010. All Pilots will complete this training by November 2010

Dual FMC and GPS are fully installed on our Classic fleet

LAD (large area displays) glass panel displays installed on Classic fleet

FAA will mandate RNAV everywhere in CONUS

FAA will also mandate RNP in busy en route and terminal airspace

APR 2010 | **OCT 2010** | **NOV 2010** | **DEC 2010** | **2011-2013** | **2014** | **2015** | **2016** | **2025**

Southwest begins flying GPS procedures

Southwest may complete its first revenue RNP flight

Southwest will fly RNP (public and special)

Automatic Callouts fully installed on our NG fleet

FAA will mandate RNP-2 at and above FL 290 and mandate RNAV at and above FL 180

FAA will also mandate RNAV for arriving/departing OEP Airports

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FEDERAL AVIATION ADMINISTRATION

CAPTAIN JEFF MARTIN
SENIOR DIRECTOR FLIGHT OPERATIONS

This initiative reaches far beyond simply adding a new type of Instrument Approach Procedure. In fact, RNP operations can be conducted over an entire flight segment. Viewing this initiative in even a broader sense, it is a complete redesign of our operational philosophy, particularly as it applies to automation.

The precision accuracy of RNP provides an added level of Safety, which is unmatched by traditional navigation capabilities—enough reason in and of itself to embrace this new technology. RNP also produces savings, which reach across the entire spectrum of flight. In addition to track mile savings, RNP allows the design of engine-out procedures that couldn't previously have been flown by our aircraft, subsequently providing an opportunity for increased maximum allowable takeoff weight. On departure, the same precision capabilities result in a reduction in the amount of required airspace, thereby allowing flight paths where they previously were restricted due to traffic separation, terrain, restricted airspace, and noise abatement. This leads to reduction in track miles, requiring less fuel, and resulting in reduced takeoff weights.

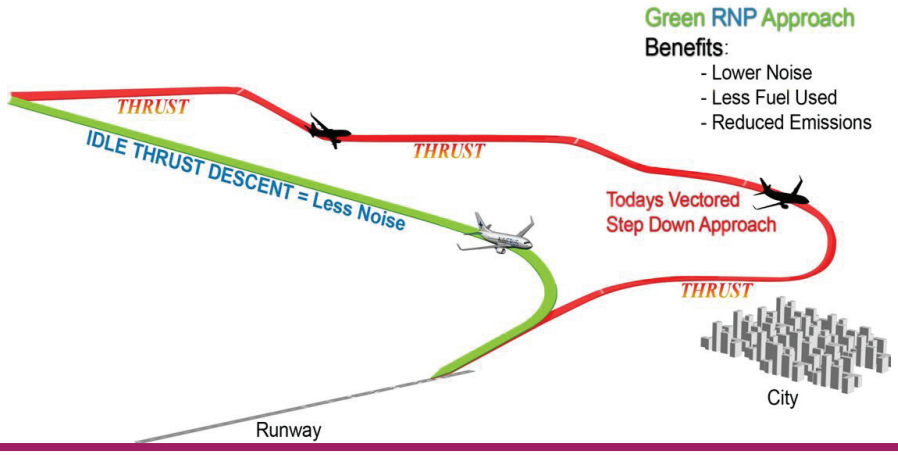
This same philosophy continues throughout arrival and approach. Additionally, on descent and arrival, strategically-designed constant descent profiles provide fuel savings over traditional step down descents. RNP approaches provide increased operational reliability due to decreased dependence on ground-based navigation systems—increased dispatch ability, ontime performance, and, most importantly, a higher level of Safety.

Combined with autothrottles, this initiative is not just a monumental shift in our operational philosophy—it is a monumental step in increasing overall Safety and reducing our operational costs.

We'll be deploying this effort in phases over the next six years. The first phase, which introduced our new automation policy, began in late 2008. Among other things, this will redefine procedures for manual flight, automatic flight, navigation displays, FMC programming/verifying, MCP, and autothrottle use.

Aircraft modifications, which are also being accomplished in phases, have already begun. We first activated autothrottles and VNAV, including FMC updates on the -700s. The next step, called Phase One modifications, began in the later part of 2008. This modification is adding a second FMC and CDU, and dual GPS to the Classic fleet. VNAV will also be activated at this time. Phase Two modifications are projected to begin in 2010/2011. This modification replaces the current complement of analog flight instruments on Classic aircraft with Glass Panel Displays. This enables a moving map display, an RNP requirement, providing increased situational awareness resulting in a higher level of Safety.

The next step in reaching our final objective will be implementing the use of VNAV on instrument approaches. On this deployment, VNAV use for approach will be limited to RNAV/GPS approaches. Pilots will receive simulator training, which will begin in September 2009. The final step is RNP operations. RNP training will be an additional simulator event planned for 2010. The goal is to be flying RNP systemwide by 2013.

Southwest Airlines is committed to RNP, and Flight Operations is committed to doing it right. We're the first U.S. carrier to commit to 100 percent RNP operations. The FAA is committed to RNP for NexGen Airspace. In cooperation with the FAA, we'll set the industry standard. A lot of work has already been accomplished, but we have a long way to go.

In the upcoming months, we'll provide each of you with a wealth of information covering the entire spectrum of this initiative. Captain Bob Torti and his Training Team will provide you with the highest quality training to ensure knowledge and proficiency. In the end, it is Flight Operations' goal that every Southwest Airlines Pilot be the industry expert in automation and RNP, and we're committed to giving you everything you need to achieve that status.