

# CALLBACK

From NASA's Aviation Safety Reporting System



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## RNAV Problems - Really Anything New?



With the improvement of navigational capabilities, Area Navigation (RNAV) and Required Navigation Performance (RNP) operations have become routine procedures for performing many terminal instrument approaches. RNAV and RNP together compose Performance Based Navigation (PBN), which uses satellites and onboard equipment for navigation procedures that are more precise and accurate than standard avionics and ground-based navigation aids.<sup>1</sup> PBN is so named because the types of routes and procedures an aircraft can fly are dependent upon the performance level of equipment and pilot training.<sup>1</sup> RNAV permits aircraft to fly any desired flight path within the coverage of ground-based or space-based navigation aids, within the limits of aircraft avionics, or with a combination of these. RNP is a more advanced form of RNAV that includes an onboard performance monitoring and alerting capability.<sup>1</sup>

The use of RNAV and RNP terminal approach procedures has grown. As of Publication Cycle 01/05/2017, the FAA Instrument Flight Procedures (IFP) Inventory Summary lists a total of 6,837 RNAV charts comprising 14,932 unique sets of approach minimums.<sup>2</sup> With expanded use of these procedures, new problems and concerns arise.

ASRS receives reports that indicate pilots experience common RNAV problems. While RNAV technology may be relatively new and still evolving, a large portion of reported problems appear to have roots in the basic knowledge and fundamentals of instrument flight. This month, *CALLBACK* examines reports depicting issues that crews encounter with RNAV operations in the terminal environment.

### The Unexpected RNAV Excursion - Back to Basics I

This air carrier crew entered the RNAV approach that they intended to fly into their FMS. An unexpected turn during the approach started the next unwelcome turn of events.

■ *I was the pilot flying. The pilot monitoring had loaded the full RNAV (GPS) RWY 34R approach. After being cleared for the approach, we got established on the inbound course. Without notification the aircraft began a right turn. Realizing that the aircraft had begun to turn, we disconnected the autopilot and attempted hand flying the aircraft back onto course. Realizing that I was descending, I began to increase power and climb the aircraft. In the descent, a TERRAIN WARNING aural alert sounded, and a go-around and missed approach were initiated.*

*Storms in the area had created a very high workload. The turn was caused by a full procedure turn that had been included during the FMS setup for the approach that should not have been there. The excessive descent was caused by a work overload for myself as the pilot flying.*

### The Unprotected RNAV Descent - Back to Basics II

This aircrew experienced a late approach change that required them to program an RNAV approach. Manually reprogramming that approach resulted in an undesirable flight condition in weather and mountainous terrain.

■ *We were filed to fly the MQUIA arrival into SKBO. Prior to MQU, the FO listened to ATIS and reported landings to Runways 13L and 13R. We briefed the ILS Runway 13L approach.... Approaching 14,000 feet,...the Approach Controller assigned 250 knots and the RNAV (GNSS) RWY 13R approach. We were also cleared direct to NEPOP. At this point I felt slightly rushed.*

*I loaded the RNAV (GNSS) RWY 13R approach, selected the NEPOP transition,...and briefed the approach. It was in the box as follows: Line 1 - NEPOP procedural hold at 13,000 feet; Line 2 - NEPOP at 12,000 feet; Line 3 - URULO (FAF) at 10,000 feet; Line 4 - RWY 13R.*

*Knowing that the Controller did not expect us to enter a procedural hold at NEPOP, I attempted to line select Line 2 (NEPOP at 12,000 feet) to Line 1. The box did not allow that action. At this time I elected to concentrate on slowing the airplane down for the approach. I directed the FO to...correct the sequence of waypoints for the intended approach. The FO thought he had solved the problem by line selecting Line 3 (URULO) to Line 2. This action displayed the proper sequence of NEPOP followed by URULO. By this time the aircraft was in the approach mode.... When VNAV was selected, VNAV PATH was displayed in the FMA. Thinking the approach was correctly sequenced, I directed the FO to set 9,100 in the MCP altitude window. The autopilot was on and soon...started a slow descent. Within a few hundred feet we broke out of the clouds.... We saw the airport and all surrounding terrain.... I suspected we were low...based on visual cues. The aircraft gave an ALTITUDE and PULL UP WARNING as we passed over a ridge. I elected to not respond to these warnings since I had visual contact on all terrain. We proceeded to Runway 13R and made a normal landing.... I now believe*

when URULO was line selected to Line 2, we lost the altitude protection of 12,000 feet at NEPOP.

## Common RNAV Automation Syndrome

A change in runway and approach type required this B737 crew to program an RNAV approach and link it to the active arrival. It proved problematic, as did Electronic Flight Bag (EFB) currency, in executing the RNAV approach.

■ *The current ATIS information listed the ILS for Runways 16C and 16R in use.... The ILS for 16R had been set up and briefed. After checking in with Seattle Approach, we were instructed to fly the RNAV (RNP) Z RWY 16C approach, which joined with the...arrival.... The Captain attempted to re-program the FMS for the new approach.... I discovered that I did not have access to the approach since...I did not perform an update on my EFB on the layover. The Captain... had updated his EFB...and did have access to the approach, so we agreed that I would brief and fly from his approach plate. In the attempt to re-program the RNAV approach in the FMC and prepare to brief, the correct sequence of waypoints along the...arrival...dropped out of the LEGS page in the FMC, and a discontinuity was created after the waypoint...directly in front of us. I had requested that the Pilot Monitoring (PM) clean up the LEGS page prior to executing the change, however this did not happen due to the high workload...on the PM at that time. Consequently, when the aircraft traversed the next waypoint and reached a discontinuity on the LEGS page, it sequenced out of LNAV and into Control Wheel Steering (CWS). We immediately saw the change and attempted to turn toward the next waypoint, correct the discontinuity, and re-engage the correct lateral navigation. We reached a lateral excursion of 1.45 [NM] prior to correcting back to the published course. ATC queried us about our lateral excursion..., and we advised them of our correction.... We continued the arrival and were re-assigned the ILS 16C approach without further event.*

## The Dubious RNAV Descent – Back to Basics III

Confusion over RNAV Instrument Approach Procedures and RNAV FMS displays allowed this corporate crew to descend below published altitudes during their RNAV approach. The result was another close encounter with terra firma.

■ *The airport reported 10 miles visibility and 900 feet scattered clouds, and the approach occurred during dusk while the sun was setting. We originally planned and briefed the visual approach with the LOC DME RWY 28L backup utilizing the FMS. The LOC DME RWY 28L was [reported out of service in the] NOTAMS. Approaching WIGGL, the IAF for both approaches, ATC informed us that we needed*

*to choose an actual approach, as the airport weather had changed to 10 miles visibility in smoke and 900 feet overcast. We asked for...the RNAV (GPS) Y RWY 28L and decided to forgo a thorough briefing and fly it with the PM guiding the Pilot Flying (PF). Unfortunately, we missed the step down fixes between the FAF and the MAP that were not represented in the FMS. There was slight confusion in the application of the step down fixes, i.e. [whether they] apply to only the LP minimums, or also to the LNAV minimums.*

*I decided to descend to the MDA as early as possible to allow for more time to search for the runway in the haze. During the level off at the MDA,...about 6 nautical miles from the runway and descending through about 1,250 feet, we received an EGPWS TERRAIN CAUTION followed immediately by an EGPWS TERRAIN WARNING. We immediately initiated the escape maneuver. We were still in VMC conditions and some distance from the runway.... Still able to remain within the “stable criteria,” we elected to level off at about 1,500 to 1,600 feet. We were clear of the EGPWS CAUTION and WARNING areas, with no audio messages and no colors depicted on the terrain map, so we continued with the descent to level off at the MDA about 3 nautical miles from the runway. At that point we saw the runway and made an uneventful approach and landing.*

## Degraded RNAV – Inspiration for Versatility

During an RNAV approach, this Mooney pilot experienced RNAV degradation that required a creative solution. It also spawned his new commitment to better preparedness.

■ *On my first approach attempt, the reported weather indicated a 300 foot ceiling with 2.5 miles visibility. I was established on the RNAV (GPS) RWY 31 approach, and shortly after the FAF, the approach downgraded to LNAV. The weather was below [LNAV] minimums, so I declared a missed approach and requested the RNAV (GPS) RWY 31 approach into [a nearby airport]. After the IAF, approximately at the FAF, the approach downgraded to an LNAV approach. I was high on final and declared a missed approach. By this time, I was lower on fuel than I expected and advised ATC of the situation. ATC advised that they would provide the ILS RWY 13 approach to save time. The receiver did not provide accurate glide slope, but ATC advised altitudes at the fixes and a landing was made without incident.... I intend to practice more ILS approaches and also LNAV approaches.*

1. [https://www.faa.gov/nextgen/update/progress\\_and\\_plans/pbn/](https://www.faa.gov/nextgen/update/progress_and_plans/pbn/)
2. [https://www.faa.gov/air\\_traffic/flight\\_info/aeronav/procedures/ifp\\_inventory\\_summary/](https://www.faa.gov/air_traffic/flight_info/aeronav/procedures/ifp_inventory_summary/)

ASRS Alerts Issued in December 2016	
Subject of Alert	No. of Alerts
Aircraft or Aircraft Equipment	9
Airport Facility or Procedure	7
ATC Equipment or Procedure	10
Other	1
<b>TOTAL</b>	<b>27</b>

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December 2016 Report Intake	
Air Carrier/Air Taxi Pilots	5,063
General Aviation Pilots	945
Controllers	538
Flight Attendants	463
Military/Other	306
Dispatchers	223
Mechanics	192
<b>TOTAL</b>	<b>7,730</b>