

## **G1000 Evolution for Diamond Owners**

**1 May 2020**

The purpose of this document is to provide a tutorial on the history, evolution, and future of the G1000/NXi so that owners can make intelligent choices about G1000 hardware and software upgrades. This document will also help owners understand where their aircraft currently fits into the overall G1000 evolutionary path, and what other G1000/NXi software and hardware exists that might become available for incorporation of newer features and functions into their aircraft.

### **GDU Software Versions**

The G1000 flight deck was introduced in 2004, with Diamond Aircraft as Garmin's launch customer for the system in the DA40. Since that time, multiple software (and hardware) changes have been incorporated as the system has evolved into today's G1000 NXi, integrated into Diamond DA40, DA42, and DA62 aircraft.

The key to understanding which features are included in various G1000 systems is the Graphical Display Unit (GDU) software version number. GDU hardware includes the Primary Flight Display (PFD) and Multifunction Display Unit (MFD) screens, each of which contain most of the G1000's processing and memory capabilities. The GDU software version number roughly corresponds to the year in which the software was introduced, e.g., GDU version **9.XX** was introduced around **2009**, GDU version **12.XX** was introduced around **2012**, etc. (An exception is G1000 NXi, with all NXi GDU software versions numbered 20.XX despite being introduced and installed in new aircraft starting in 2017.)

Note that GDU version numbers are not the same as software version numbers, which are aircraft-specific and don't indicate the level of functionality. For example, Lycoming DA40 XLS/XLT aircraft can run software 0321.23, which is GDU version 12.01.

### **Legacy G1000 vs. G1000 NXi**

From 2004 until early 2017, all G1000 PFD/MFD screens delivered in new aircraft had exactly the same processing and memory capability, a remarkably long period of time given the otherwise rapid evolution of computers and electronics. But eventually the use of 2004-era processors limited the incorporation of additional functionality into the G1000, which reached its maximum with the release of GDU version 15.XX software around 2015.

To permit further evolution of the G1000, Garmin started shipping improved PFD/MFD screens in 2017, each with dual processors with more than 100X the processing capabilities of the original 2004 screens. To identify these newer systems, Garmin renamed the latest flight decks as "G1000 NXi." NXi PFDs and MFDs also have considerably more internal memory, capable of holding all of the databases internally without SDcards being required except for loading of updated databases into internal memory. With this additional processing and memory,

G1000 NXi systems include additional software functionality, and are expected to include even more features in the future.

The G1000 NXi aircraft that were delivered starting in 2017 continued to make use of the GIA63W integrated avionics units that were introduced in 2004; these flight decks became designated as “NXi Phase I.” But shortly thereafter, Garmin ceased production of GIA63Ws, which were replaced by newer-technology GIA64Ws with identical GPS/radio/navigation functionality (but requiring different software). In addition, Garmin stopped producing 2004-era audio GMA1347 audio panels that were replaced by GMA1360 audio panels with 3D audio and Bluetooth, and GEA71 engine/airframe interfaces were replaced with GEA71B hardware. G1000 NXi systems with a combination of these newer GIAs, GMA, and GEA hardware and software are designated as “NXi Phase II” – and represent the latest evolution of G1000 technology.

### **Current GDU Levels**

So what GDU software versions are the newest that are available and certified to run on various Diamond aircraft equipped with G1000 or NXi flight decks? Here is a breakout of the Diamond G1000 fleet by model (numbers of aircraft through the end of 2019):

#### Legacy G1000

DA40-180 and XL Lycoming non-WAAS, about 450 aircraft running **GDU 9.14**

DA40 XLS/XLT Lycoming with WAAS, about 600 aircraft running **GDU 12.01**

DA40D Thielert non-WAAS, about 250 aircraft running **GDU 5.02**

DA40NG Austro with WAAS, about 350 aircraft running **GDU 11.13**

DA42 TDI Thielert non-WAAS, about 500 aircraft running **GDU 9.05**

DA42NG/-VI Austro with WAAS, about 340 aircraft running **GDU 15.11**

DA62 Austro with WAAS, about 45 aircraft running **GDU 15.12**

#### G1000 NXi

DA40NG NXi Phase I Austro with WAAS, about 125 aircraft running **GDU 20.05**

DA40NG NXi Phase II Austro with WAAS, about 100 aircraft running **GDU 20.80**

DA40 XLT NXi Phase II Lycoming with WAAS, about 0\* aircraft running **GDU 20.90**

(\* DA40 XLT NXi Phase II was certified in March 2020 and is now being delivered.)

DA42NG/-VI NXi Phase I Austro with WAAS, about 90 aircraft running **GDU 20.06**

DA42NG/-VI NXi Phase II Austro with WAAS, about 70 aircraft running **GDU 20.81**

DA62 NXi Phase I Austro with WAAS, about 90 aircraft running **GDU 20.05**

DA62 NXi Phase II Austro with WAAS, about 0\*\* aircraft running **GDU 20.89**

(\*\* DA62 NXi Phase II was certified March 2020 and is now being delivered.)

## **GDU Version Functionality**

Given that the GDU software version number indicates the year of introduction, and the relative functionality of a G1000 flight deck, here are the incremental features that were incorporated into each new release.

LEGACY G1000:

### GDU 5 (2005)

Includes Thielert DA40D aircraft

- Basic flight deck functionality only
- KAP-140 autopilot only

### GDU 9 (2009)

Includes Lycoming DA40-180 and XL, DA42 TDI aircraft

- Capable of supporting options such as GIA63Ws (WAAS), TAS600 active traffic, and Synthetic Vision (SVT)
- Flight data logging on SDcard (but not on DA42 TDI)
- Electronic checklists
- GFC700 (DA40 XL only) as well as KAP140 autopilots
- Unable to display ADS-B FIS-B weather on MFD if GTX345R installed (ADS-B traffic display only on MFD)

### GDU 11 (2011)

Includes DA40NG Legacy G1000

- Selected Altitude Intercept Arc: “the banana” predicts where aircraft will be located along the magenta course line on map when it reaches a climb or descent target altitude

### GDU 12 (2012)

Includes Lycoming DA40 XLS/XLT and requires GIA63Ws (WAAS)

- Can fly LPV WAAS approaches but not LP WAAS approaches (despite LP approaches included in NavData database files).
- Dual Navigation Database: permits NavData database to be loaded into “Standby” memory before effective date, and then automatically moved from Standby to “Active” on or after the effective date.
- Automatic Database Synchronization: for other database files (e.g., Terrain, Obstacle, SafeTaxi, etc.), ensures that bottom SDCards both have the latest database files in case only one SDcard is updated.
- Selecting Vectors-to-Final on approaches no longer removes step-down fixes/waypoints located outside the FAF
- Electronic checklists deleted (for DA40)
- Can display ADS-B weather as well as traffic on MFD if GTX345R installed.

### GDU 15 (2015)

Includes Legacy G1000 DA42NG (-VI) and Legacy G1000 DA62

- Can fly LP as well as LPV WAAS approaches

- User-Defined Holding Patterns: can be based upon any waypoint/fix in NavData database, or a user-defined waypoint
- Temperature-Compensated Altitude: adjusts instrument approach vertical guidance in very cold weather
- GDL69A SXM (using newer Sirius satellite for weather) replaces GDL69A (that uses the original XM satellite weather satellite)
- Higher-resolution Synthetic Vision: shows more detail in 3D on PFD, using larger, high-resolution 4.9 arc-second terrain database (replacing 9 arc-second terrain database that had fewer data points)
- New NavData database format: nav2\_db.bin replaces older avtn\_db.bin used by pre-GDU v15 G1000s to accommodate a larger number of airports and more data
- Ability to use GIA63Ws as WAAS position source to drive ADS-B transponder (GTX33ES or GTX345R), eliminating need for more expensive transponder with its own built-in WAAS and 3<sup>rd</sup> WAAS GPS antenna connection
- GDU 15 is the final software release for Legacy G1000, since 2004-era processors and memory limit more functionality being added.

IMPORTANT NOTE: Other Limitations of Legacy G1000 software (i.e., GDU 15.XX or earlier):

- Because the GTX345R for ADS-B In/Out was introduced **after** Legacy G1000 software was already released, reloading of G1000 software requires a software patch (by laptop) for GTX345R functionality that's not included with the G1000 Loader SDcard. This needlessly complicates G1000 hardware/software repair and replacement.
- Despite installation of GTX345R transponders to satisfy the FAA 2020 ADS-B Out mandate and provide traffic and free weather information, Legacy G1000 software is incapable of displaying the FAA's newer ADS-B IN weather products on G1000 screens. Missing ADS-B weather information includes lightning, turbulence, icing, cloud tops, graphical AIRMETS, and Center Weather Advisories.
- No Garmin bug fixes since time of Legacy GDU software release.

G1000 NXi:

#### GDU 20.0X NXi Phase I

Includes DA40NG, DA42-VI, and DA62 with GIA63Ws (2017-2019)

- Dual processors in PFD and MFD each provide 100X the compute power of 2004-era Legacy G1000 screens
- Screens are much brighter with new fonts and font smoothing for greater legibility
- Vertical Situation Display (VSD) on MFD displays terrain profiles, winds aloft, and flight plan profile view
- HSI map overlay includes weather, traffic, terrain on PFD
- Integrated GTX345R ADS-B In weather and traffic (includes Garmin Target Trend and Terminal Traffic display)
- Communications frequency ID display on PFD reduces the risk of loading the wrong communications frequencies
- VFR sectional and IFR en-route charts on MFD

- Faster boot times for system
- Can simultaneously load Garmin FliteCharts and (optional) Jeppesen Chartview and switch between them
- Separate dedicated Engine page added for Austro Engine aircraft
- DA62 Aux tank fuel levels displayed
- Simplified database management (single SDcard loads databases into entire system; no need to keep SDcards in bottom slots)
- FlightStream 510 wireless SDcard (DA62 only, requires NXi Phase II for DA40NG, DA42-VI, DA40 XLT)
- No more NXi Phase I software releases are expected to be forthcoming; owners will need to install NXi Phase II hardware (see below) for future software features and bug fixes.

#### GDU 20.80 and above NXi Phase II

Includes DA42-VI and DA40NG since mid-2019, DA62 in 2020, Lycoming DA40 XLT in 2020

- Requires pair of GIA64Ws (replacing pair of GIA63Ws) and GEA71B replaces older GEA71 engine/airframe interface unit
- Requires new GMA 1360 audio panel with 3D audio and Bluetooth, replaces older GMA 1347 audio panel
- FlightStream 510 wireless card synchronizes panel weather, traffic, AHRS with iPad running Foreflight or Garmin Pilot; Garmin Pilot also can wirelessly load NavData and other databases into the G1000 NXi panel
- Animation of NEXRAD weather on MFD
- Split-screen MFD for simultaneously displaying charts and flight plan

Future G1000 NXi Phase II Features potentially expected in the coming year that have already been delivered for other (i.e., non-Diamond) airframes:

- Visual Approaches: G1000 NXi creates a synthetic 3-degree glideslope for landing on runways where there are no published instrument approaches.
- SurfaceWatch: helps keep pilots from using too-short runways, landings/takeoffs on taxiways; provides greater situational awareness when taxiing.
- Newer ADS-B In weather products displayed on PFD or MFD screens that are currently “missing,” including lightning, turbulence, icing, cloud tops, graphical AIRMETS, and Center Weather Advisories.
- WireAware: display of important cable obstacles near airports, across valleys, etc.