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Flight Standardization Board (FSB) Report

Revision: 1
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Manufacturer
Gulfstream Aerospace Corporation

Type Certificate Data Sheet (TCDS)	TCDS Identifier	Marketing Name	Pilot Type Rating
T00021AT	GVII-G500	G500	GVII

Approved By: Transport Aircraft Long Beach Branch
Federal Aviation Administration (FAA)
Aircraft Evaluation Division
3960 Paramount Boulevard, Suite 100
Lakewood, CA 90712-4137

Office Telephone: (562) 627-5270
Office Fax: (562) 627-5210
Office Email: 9-AVS-AFS-100@faa.gov

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1. RECORD OF REVISIONS

Revision Number	Sections(s)	Page(s) Affected	Date
Original	ALL	ALL	09/14/2018
1	Cover Page, Table of Contents, Record of Revisions, Highlights of Change, Special Emphasis Appendix 4, Appendix 5	2, 3, 9, 16, 17	02/27/2019

2. INTRODUCTION

Aircraft Evaluation Groups (AEG) are responsible for working with aircraft manufacturers and modifiers during the development and Federal Aviation Administration (FAA) certification of new and modified aircraft to determine: 1) the pilot type rating; 2) flightcrew member training, checking, and currency requirements; and 3) operational suitability.

This report lists those determinations for use by: 1) FAA employees who approve training programs; 2) FAA employees and designees who certify airmen; and 3) aircraft operators and training providers to assist them in developing their flightcrew member training, checking, and currency.

3. HIGHLIGHTS OF CHANGE

Page 8, updated section 9.2.2 paragraph e).

Page 16, added Appendix 4, Required Navigation Performance Authorization Required (RNP-AR).

Page 17, added Appendix 5, Enhanced Flight Vision System (EFVS) Operations.

4. BACKGROUND

The Transport Aircraft Long Beach Branch formed a Flight Standardization Board (FSB) that evaluated the GVII-G500 as defined in FAA Type Certificate Data Sheet (TCDS) #T00021AT. The evaluation was conducted during June–July 2018 using the methods described in FAA Advisory Circular (AC) 120-53B, Guidance for Conducting and Use of Flight Standardization Board Evaluations.

The GVII-G500 features Fly-by-Wire (FBW) which interfaces with dual active control sidesticks and is powered by Pratt & Whitney (PW) PurePower PW814GA turbofan engines producing 15,144 lbs of thrust.

The Gulfstream Symmetry Flight Deck based on the Honeywell Primus Epic integrated avionics system with the Smartview Synthetic Vision System (SVS), two-dimensional (2-D) and three-dimensional (3-D) airport moving maps, and a cockpit display of traffic information, features 10 integrated touchscreens used for system controls, flight management, communications, electronic checklists (ECL), and monitoring of weather and flight information.

The aircraft is equipped with a Head-Up Display ((HUD) III/Enhanced Vision System (EVS) III) architecture system.

The GVII-G500 is certificated to a maximum of 19 passengers and 22 occupants (including 1 pilot, 1 co-pilot, and 1 flight attendant).

Maximum (certified) takeoff weight (MTOW) for the GVII-G500 is 79,600 lbs.

5. ACRONYMS

14 CFR	Title 14 of the Code of Federal Regulations
91K	91 Subpart K
2-D	Two-Dimensional
3-D	Three-Dimensional
AC	Advisory Circular
ACFT	Aircraft
ACS	Airman Certification Standards
AEG	Aircraft Evaluation Group
AFCS	Automatic Flight Control System
AFM	Airplane Flight Manual
APU	Auxiliary Power Unit
AT	Autothrottle
ATP	Airline Transport Pilot
AV	Audiovisual Presentation
CAS	Crew Alert System
CDL	Configuration Deviation List
CPT	Cockpit Procedures Trainers
DCN	Data Concentration Network
ECL	Electronic Checklist
EDM	Automatic Emergency Descent Mode
EFB	Electronic Flight Bag
EFVS	Enhanced Flight Vision System
EGPWS	Enhanced Ground Proximity Warning System
EVS	Enhanced Vision System
FAA	Federal Aviation Administration

FBW	Fly-by-Wire
FD	Flight Director
FDOS	Flight Deck Observer Seat
FFS	Full Flight Simulator
FMS	Flight Management System
FPV	Flight Path Vector
FSB	Flight Standardization Board
FSTD	Flight Simulation Training Device
FTD	Flight Training Device
HO	Handout
HUD	Head-Up Display
ICBI	Interactive Computer Based Instruction
ICS	Intercom System
IFIS	Integrated Flight Information System
LPV	Localizer Performance with Vertical Guidance
MDR	Master Differences Requirements
MMEL	Master Minimum Equipment List
MTOW	Maximum (Certified) Takeoff Weight
NAS	National Airspace System
NWSS	Nose Wheel Steering System
PTS	Practical Test Standards
PTT	Part Task Trainers
PW	Pratt & Whitney
RNP AR	Required Navigation Performance Authorization Required
SU	Stand-up Instruction
SVS	Synthetic Vision System
TC	Type Certificate
TCAS	Traffic Alert and Collision Avoidance System
TCBI	Tutorial Computer Based Instruction
TCDS	Type Certificate Data Sheet
V_{MO}/M_{MO}	Maximum Operating Limit Speed

6. DEFINITIONS

These definitions are for the purposes of this report only.

6.1. Base Aircraft. An aircraft identified for use as a reference to compare differences with another aircraft.

6.2. Current. A crewmember meets all requirements to operate the aircraft under the applicable operating part.

6.3. Differences Tables. Describe the differences between a pair of related aircraft, and the minimum levels operators must use to conduct differences training and checking of crewmembers. Difference levels range from A to E.

6.4. Master Differences Requirements (MDR). Specifies the highest training and checking difference levels between a pair of related aircraft derived from the Differences Tables.

6.5. Mixed Fleet Flying. The operation of a base aircraft and one or more related aircraft for which credit may be taken for training, checking, and currency events.

6.6. Operational Evaluation. An AEG process to determine pilot type rating, minimum crewmember training, checking and currency requirements, and unique or special airman certification requirements (e.g., specific flight characteristics, no-flap landing).

6.7. Operational Suitability. An AEG determination that an aircraft or system may be used in the National Airspace System (NAS) and meets the applicable operational regulations (e.g., Title 14 of the Code of Federal Regulations (14 CFR) parts 91, 135).

6.8. Qualified. A crewmember holds the appropriate airman certificate and ratings as required by the applicable operating part.

6.9. Related Aircraft. Any two or more aircraft of the same make with either the same or different type certificates that have been demonstrated and determined by the Administrator to have commonality.

6.10. Seat Dependent Tasks. Maneuvers or procedures using controls that are accessible or operable from only one flightcrew member seat.

6.11. Special Emphasis Area. A training requirement unique to the aircraft, based on a system, procedure, or maneuver, which requires additional highlighting during training. It may also require additional training time, specialized training devices, or training equipment.

6.12. Specific Flight Characteristics. A maneuver or procedure with unique handling or performance characteristics that the FSB has determined must be checked.

7. PILOT TYPE RATING

7.1. Type rating. The Gulfstream GVII-G500 type rating designation is GVII.

7.2. Common type ratings.

Not applicable.

7.3. Military equivalent designations. Military aircraft that qualify for the GVII type rating designation can be found on the faa.gov website under Licenses and Certificates, Airmen Certification, Online Services, Aircraft Type Rating Designators. This webpage is kept up to date and can be found at:
http://www.faa.gov/licenses_certificates/airmen_certification.

8.   RELATED AIRCRAFT

8.1. Related Aircraft on same TCDS.

Not applicable.

8.2. Related Aircraft on different TCDS.

Not applicable.

9.   PILOT TRAINING

9.1. Airman Experience.

Airmen receiving initial GVII-G500 training will benefit from prior experience operating multi-engine transport turbojet aircraft in accordance with parts 91 or 135. Additionally, a working knowledge of systems, such as Automatic Flight Control System (AFCS), autothrottle (AT), flight management system (FMS), Integrated Flight Information System (IFIS), ECL, Electronic Flight Bags (EFB), HUD, highly integrated avionics systems with electronic flight displays, high altitude operations, military, and FMS experience may be necessary to complete the training in a timely manner. Pilots without this experience may require additional training.

9.2. Special Emphasis Areas

9.2.1   Pilots must receive special emphasis on the following areas during ground training:

a) Abnormal/emergency guidance. Gulfstream's philosophy is to not identify any steps in the GVII-G500 abnormal or emergency procedures as so-called "memory items". Pilots are expected to perform some initial and critical steps without reference to any documentation. In addition, pilots are expected to don oxygen masks promptly when appropriate (e.g., when smoke is detected). Operators and training providers should ensure pilots are trained accordingly during initial, transition, upgrade, and recurrent training. The following are examples of procedures that the initial/critical steps should be performed promptly without reference to a checklist:

- Engine fire/auxiliary power unit (APU) fire.
- Engine failure after V_1.
- Cabin pressure low/emergency descent.
- Engine exceedance.
- Enhanced ground proximity warning system (EGPWS)/windshear/Traffic Alert and Collision Avoidance System (TCAS) alerts.
- Sidestick fail.
- Ground spoilers armed.

- Brake-by-Wire fail (U) (ground procedures).

b) Crew Alert System (CAS) message philosophy. Must be trained in initial, transition, upgrade, and recurrent training.

c) Data Concentration Network (DCN). This should include instruction on the system architecture, crew actions, and checklist. This should include training on Airplane Flight Manual (AFM) DCN dispatch limitations that take precedence over Master Minimum Equipment List (MMEL) relief. This item must be included in initial, transition, upgrade, and recurrent training.

d) Flight control modes. This aircraft utilizes FBW flight controls. It is important to thoroughly understand the operation of the aircraft in each of the flight control modes. This item must be included in initial, transition, upgrade, and recurrent training.

e) Zero-flap landing, including the effects of the wing anti-ice on stall protection and approach speeds, high idle thrust, and the need to positively fly the nose gear to the runway after main gear touchdown. This item must be included in initial, transition, upgrade, and recurrent training.

f) Location and proper donning of the smoke goggles. Pilots should demonstrate the proper donning of the oxygen mask and smoke goggles in the classroom, flight simulation training device (FSTD), or aircraft during initial, transition, upgrade, and recurrent training.

g) Automatic Emergency Descent Mode (EDM). The Speedbrakes deploy automatically during EDM and should be allowed to do so. When speedbrakes auto-deploy, they do so only after established in the descent when near maximum operating limit speed (V_{MO}/M_{MO}). This item must be included in initial, transition, upgrade, and recurrent training.

h) Engine operations in icing. Training should include classroom instruction of vibrations, associated odors, and energy management operations with increased idle thrust. This training must be included in initial, transition, upgrade, and recurrent training.

9.2.2 Pilots must receive special emphasis on, and perform the following areas during, flight training:

a) HUD systems. Relationship between boresight, Flight Path Vector (FPV), flight director (FD) and V-speed awareness band during all engine and single engine takeoff operations. This item must be included in initial, transition, upgrade, and recurrent training.

b) Proper takeoff and rotation technique during all HUD and non-HUD operations. This item must be included in initial, transition, upgrade, and recurrent training.

c) Flight control modes. This aircraft utilizes FBW flight controls. It is important to thoroughly understand the operation of the aircraft in each of the flight control modes. This item must be included in initial, transition, upgrade, and recurrent training.

d) EDM. The Speedbrakes deploy automatically during EDM and should be allowed to do so. When speedbrakes auto-deploy, they do so only after established in the descent when near VMO/MMO. This item must be included in initial, transition, and upgrade training.

e) Location and proper donning of the smoke goggles. Pilots will demonstrate to an instructor in the FSTD, or aircraft, the ability to don their oxygen mask and smoke goggles and establish communication with the other pilot over the intercom system (ICS). Pilots must don the oxygen mask within 5 seconds. Pilots must don the smoke goggles and establish communications within a reasonable time, such that they can maintain aircraft control and accomplish any necessary smoke removal tasks. Pilots will accomplish this demonstration while wearing any required glasses, as well as a headset. Pilots should be encouraged to practice with or use their personal headset, as special techniques may be required to use some headsets with the oxygen mask. This must be accomplished during initial, transition, upgrade, and recurrent training.

f) Engine operations in icing. Training should include full flight simulator (FFS) demonstration of vibrations, energy management operations with increased idle thrust, and discussion of possible odor. It is not recommended that this training be conducted in an airplane during flight. This training must be included in initial, transition, upgrade, and recurrent training.

g) Glareshield panels. Use of glareshield panels for night flight. These must be in place for takeoff and landing at night. See Configuration Deviation List (CDL). Training in stowing and deploying. This training must be included in initial, transition, and upgrade training.

h) Nose Wheel Steering System (NWSS) to include rudder pedal authority for both left and right seat. This training must be included in initial, transition, and upgrade training.

9.3. Specific Flight Characteristics.

Maneuvers/procedures required to be checked as referenced in the airline transport pilot (ATP) and type rating practical test standards (PTS), or Airman Certification Standards (ACS), as applicable.

There are no specific flight characteristics.

9.4. Seat Dependent Tasks.

    a) HUD (left seat). Initial, upgrade, and recurrent training.
    b) EFVS (left seat). Initial, upgrade, and recurrent training.
    c) Passenger oxygen system activation (right seat). Initial, transition, upgrade, and recurrent training.
    d) NWSS (left seat). Initial, transition, upgrade, and recurrent training.

9.5. Regulatory Training Requirements which are not Applicable to the GVII.

None.

9.6. FSTDs.

There are no specific systems, procedures, or maneuvers that are unique to the GVII-G500 that require a specific FSTD for training.

9.7. Training Equipment.

There are no specific systems or procedures that are unique to the GVII-G500 that require specific training equipment.

9.8. Differences Training Between Related Aircraft.

Not applicable.

10. PILOT CHECKING

10.1. Landing from a No Flap or Non Standard Flap Approach.

The probability of flap extension failure on the GVII-G500 is not extremely remote due to system design. Therefore, demonstration of a no-flap approach and landing during pilot certification or a 14 CFR part 61, § 61.58 proficiency check, part 91, § 91.1065 competency check, 14 CFR part 125, § 125.287 competency check, or part 135, § 135.293 competency check is required.

Refer to Order 8900.1, Volume 5 when the test or check is conducted in an aircraft versus an FFS.

10.2. Specific Flight Characteristics.

Maneuvers/Procedures required to be checked as referenced in the ATP and Type Rating PTS or ACS, as applicable.

There are no specific flight characteristics.

10.3. Seat Dependent Tasks.

There are no seat dependent tasks.

10.4. Other Checking Items.

   a) Precision approach using HUD and EFVS. Initial and recurrent checking.
   b) Localizer performance with vertical guidance (LPV) approach. Initial checking.

10.5. FSTDs.

There are no specific systems, procedures, or maneuvers that are unique to the GVII-G500 that require a specific FSTD for checking.

10.6. Equipment.

There are no specific systems or procedures that are unique to the GVII-G500 that require specific equipment.

10.7. Differences Checking Between Related Aircraft.

Not applicable.

11. PILOT CURRENCY

There are no additional currency requirements for the GVII-G500 other than those already specified in parts 61, 125, and 135.

11.1. Differences Currency Between Related Aircraft.

Not applicable.

12. OPERATIONAL SUITABILITY

The GVII-G500 is operationally suitable for operations under parts 91, 125, and 135. The FSB determined operational compliance by conducting an evaluation of aircraft serial numbers 72003 and 72004 during a series of flights from July 25, 2018, through July 26, 2018. The list of operating rules evaluated is on file at the Transport Aircraft Long Beach Branch.

13. MISCELLANEOUS

13.1. Flightcrew Sleeping Facilities (Part 135).

Flightcrew sleeping facilities have not been evaluated.

13.2. FDOS.

The FDOS in the GVII-G500 is part of the type certificate (TC) design. The FDOS was evaluated in aircraft serial number 72004 during a 3.5-hour operational suitability flight conducted on July 26, 2018. The FSB has determined that the FDOS meets the requirements of §§ 125.317(b) and 135.75(b) and the current edition of AC 120-83, Flight Deck Observer Seat and Associated Equipment.

13.3. Landing Minima Categories (Reference 14 CFR Part 97, § 97.3).

The GVII-G500 is considered Category C aircraft for the purposes of determining "straight-in landing weather minima."

13.4. Normal Landing Flaps.

The GVII-G500 normal "final landing flap setting" per § 91.126(c) is flaps 39.

APPENDIX 1. DIFFERENCES LEGEND

Training Differences Legend

Differences Level	Type	Training Method Examples	Conditions
A	Self-instruction	• Operating manual revision (Handout (HO)) • Flight crew operating bulletin (HO)	• Crew has already demonstrated understanding on base aircraft (e.g., updated version of engine). • Minor or no procedural changes required. • No safety impact if information is not reviewed or is forgotten (e.g., different engine vibration damping mount). • Once called to attention of crew, the difference is self-evident.
B	Aided instruction	• Audiovisual presentation (AV) • Tutorial computer based instruction (TCBI) • Stand-up instruction (SU)	• Systems are functionally similar. • Crew understanding required. • Issues need emphasis. • Standard methods of presentation required.
C	Systems Devices	• Interactive (full-task) computer based instruction (ICBI) • Cockpit procedures trainers (CPT) • Part task trainers (PTT) • Level 4 or 5 flight training device (FTD 4-5)	• Training can only be accomplished through systems training devices. • Training objectives focus on mastering individual systems, procedures, or tasks versus highly integrated flight operations or "real-time" operations. • Training devices are required to assure attainment or retention of crew skills to accomplish more complex tasks usually related to aircraft systems.
D	Maneuvers Devices	• Level 6 or 7 flight training device (FTD 6-7) • Level A or B full flight simulator (FFS A-B)	• Training can only be accomplished in flight maneuver devices in a real-time environment. • Training requires mastery of interrelated skills versus individual skills. • Motion, visual, control loading, and specific environmental conditions may be required.
E	Level C/D FFS or Aircraft	• Level C or D full flight simulator (FFS C-D) • Aircraft (ACFT)	• Motion, visual, control loading, audio, and specific environmental conditions are required. • Significant full task differences that require a high fidelity environment. • Usually correlates with significant differences in handling qualities.

Checking Differences Legend

Differences Level	Checking Method Examples	Conditions
A	None	None
B	• Oral or written exam • Tutorial computer based instruction self-test (TCBI)	• Individual systems or related groups of systems.
C	• Interactive (full-task) computer based instruction (ICBI) • Cockpit procedures trainers (CPT) • Part task trainers (PTT) • Level 4 or 5 flight training device (FTD 4-5)	• Checking can only be accomplished using systems devices. • Checking objectives focus on mastering individual systems, procedures, or tasks.
D	• Level 6 or 7 flight training device (FTD 6-7) • Level A or B full flight simulator (FFS A-B)	• Checking can only be accomplished in flight maneuver devices in a real-time environment. • Checking requires mastery of interrelated skills versus individual skills. • Motion, visual, control loading, and specific environmental conditions may be required.
E	• Level C or D full flight simulator (FFS C-D) • Aircraft (ACFT)	• Significant full task differences that require a high fidelity environment.

APPENDIX 2. MASTER DIFFERENCES REQUIREMENTS (MDR) TABLE

Not applicable.

APPENDIX 3 DIFFERENCES TABLES

Not Applicable.

APPENDIX 4 REQUIRED NAVIGATION PERFORMANCE AUTHORIZATION REQUIRED (RNP-AR)

The RNP-AR training is defined in Advisory Circular (AC) 90-101A, Approval Guidance for RNP Procedures with AR, Appendix 4, Operational Considerations, and Appendix 5 (as amended). Training must be accomplished during initial, recurrent, transition, or upgrade training prior to conducting RNP-AR approaches.

The FSB has determined that RNP-AR approach capability installed in the GVII-G500 aircraft is operationally suitable under Title 14 of the Code of Federal Regulations (14 CFR) parts 91, 125, and 135.

An operational suitability determination and completion of RNP-AR training and checking does not constitute an operational authorization. Operators should reference the current edition of AC 90-101A for RNP-AR application preparation and processing.

APPENDIX 5. ENHANCED FLIGHT VISION SYSTEM (EFVS) OPERATIONS

Refer to Title 14 of the Code of Federal Regulations (14 CFR) part 61, § 61.66 for training, recent flight experience, and proficiency requirements for EFVS operations. Refer to Advisory Circular (AC) 90-106A, Enhanced Flight Vision Systems (as amended), 14 CFR part 91, § 91.1065(g) or part 135, § 135.293(i), as applicable for EFVS task requirements during part 91 subpart K (91K) or part 135 competency checks.

The FSB has determined that Enhanced Flight Vision System (EFVS) Operations are operationally suitable under part 91, § 91.176(a) or (b).

An operational suitability determination does not constitute an operational authorization.