303 325-3873 // office
7385 S. Peoria St Unit C4
Englewood, CO 80112
www.peregrine.aero

To		Date	
		Document	
Subject	**Gulfstream G150 – Flap/Slat Actuator Heater System Supplemental Type Certificate**		

Thank you for your inquiry regarding the Peregrine-developed, US FAA approved solution that resolves issues with the G150 flap and slat actuation systems that may arise during approach and landing in certain situations. Attached is detailed information regarding the solution and process, including a white paper, project description, frequently asked questions, and the US FAA STC ST01075DE.

In addition to the attached formal quote, here is a summary of the Peregrine offer.

US FAA STC Only

Peregrine will provide the US FAA STC and associated components for installation by your preferred repair station. The price is $99,950US and includes license, documentation, parts, installation kit; Ex works (EXW), Peregrine facility, USA. A deposit of $75,000US is required upon client acceptance. Note that the parts are available exclusively from Peregrine. The lead time is approximately six months after receipt of order.

Turnkey Package

Peregrine also offers a turnkey solution including labor, US FAA STC and project management for complete installation and return to service of your G150 at our selected Denver, Colorado USA area US FAA authorized repair station. The repair station has completed installations of this STC, including installation of the Gulfstream FAST G150 aircraft.

The turnkey price is $149,950US and includes license, documentation, parts, install kit, and Peregrine program management; EXW, Peregrine facility, USA. A deposit of $75,000US is required upon client acceptance. Note that the parts are exclusively available from Peregrine. The lead time is approximately six months after receipt of order. The estimated turn time for installation is three weeks.

We look forward to providing our solution to you for your Gulfstream G150 operation. Please address any question or comments to me directly.

Thank you for your consideration.

Regards,

/s/ David Rankin

President, Peregrine

Copy: D. Sam

Attached: Quotation, Gulfstream G150 Flap / Slat Actuator Heater System STC White Paper, Frequently Asked Questions, US FAA STC ST01075DE

// Proprietary and Confidential Information //

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To		Date	
		Document	
Subject	**Gulfstream G150 – Flap/Slat Actuator Heater System Supplemental Type Certificate**		

Quotation

Quotation for ST10075DE, "Gulfstream G150 – Flap/Slat Actuator Heater System Supplemental Type Certificate" provide pricing for the STC and system components for customer arranged installation or STC, system components and managed installation at our affiliated FAA Repair Station at Centennial Airport, Englewood, Colorado, USA.

☐ **US FAA STC Only**

STC
Installation kit including Peregrine-specific heaters and control modules
Installation materials, brackets and switch
Permission letter for installation by your repair station ..... $99,950. US

☐ **Turnkey Package**

STC
Installation kit including Peregrine-specific heaters and control modules
Installation materials, brackets and switch
Permission letter for installation by our affiliated repair station at KAPA
Installation management..... $149,950. US

Terms:

- Ex Works, Peregrine Facility, Colorado, USA
- Buyer: freight, duty, insurance prepaid and added
- Deposit: $75,000. US to initiate order and delivery of the STC and/or installation
- STC Only: Balance due prior to delivery of STC and equipment
- Turnkey Package: Balance due prior to aircraft delivery
- This quote valid for 60 days from date of this letter
- Turnkey Package: Any additional work shall be negotiated directly with installation facility

For:

	Peregrine
	7385 S Peoria St Unit C4
	Englewood, CO 80112 USA
By:	By: David Rankin, President

// Proprietary and Confidential Information //

Gulfstream G150 Flap/Slat Actuator Heater System STC

Peregrine Avionics

Summary

Peregrine has developed an approved solution to resolve issues with the G150 flap and slat actuation systems that may arise during approach and landing in certain situations. When a G150 has been exposed to precipitation or high humidity, followed by exposure to freezing temperature at altitude, the flap and slat actuation drives can freeze, preventing the high lift devices from deploying. A no-flap/no-slat landing configuration can lead to a steeper descent path and high-speed landings without flap or slat deployment; possibly requiring a diversion away from the destination airport. Operational impacts may include costly diversions to alternate destination with a runway of suitable length, passenger-experienced delays and increased direct and indirect operational costs.

I. Introduction

Gulfstream G150 aircraft can experience freeze-up of the slat or flap actuation system that can prevent their deployment during approach and landing phases of flight. The Peregrine STC covers the installation of wrap-around, cuff-style heaters (Figure 3), controls, monitoring systems and cockpit indications.

The G150 flap and slat drive system is composed of a Power Drive Unit (PDU), flexible drive shafts, and twelve linear ball screw actuators (3 per wing, 2 systems) as shown in Figure 1. The STC does not modify the G150 Flap/Slat drive system including controls, indications, safety mechanisms or recommended lubrication maintenance procedures. The existing Flap/Slat actuators are modified by the installation of external supplemental heaters only.

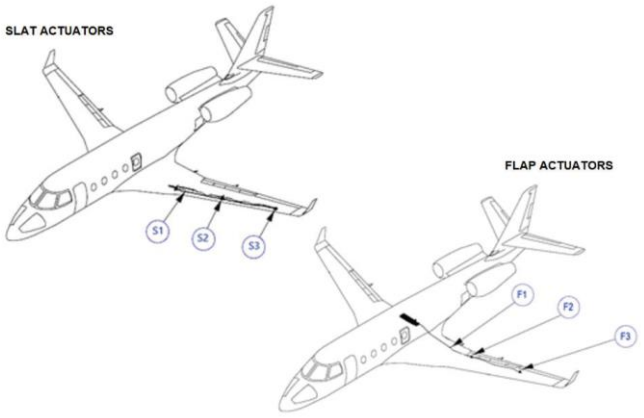

Figure 1: G150 Equipment Installation Locations, Left Wing Shown. STC does not modify the G150 Flap/Slat drive system including controls, indications, safety mechanisms or recommended lubrication maintenance procedures

II. System Description - Heater Cuff System

The Peregrine STC installation kit includes Peregrine-specific control and heater components. The Flap/Slat Actuator Heating System (FSAHS), when powered on by the cockpit ON/OFF switch, shown in Figure 2, is designed to automatically heat the actuator when temperatures are below 40° F. Thermistors installed on each heater are used to both activate the heaters at the proper temperature and ensure the actuator never reaches the upper operating temperature limit of 130° F.

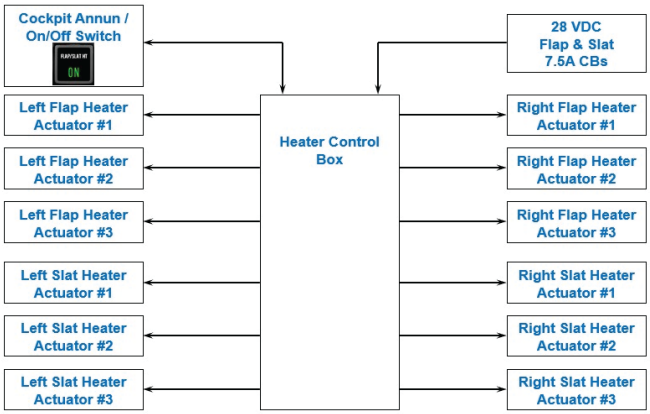

Figure 2: Heater Cuff System Overview

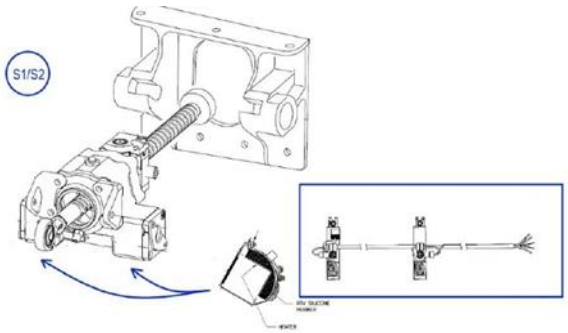

Figure 3: Wrap-around, cuff-style, design and are mounted on the exterior of the actuators

III. System Control Logic

The Flap/Slat Actuator Heating Control Unit (FSHCU) has two separate sections (channels); one controls the six (6) flap actuator heater circuits while the

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other controls the six (6) slat actuator heater circuits. The controller will activate all of the heaters on a channel when any of the sensors on that channel read a temperature below 40° F. To prevent overheating actuators, if any of the channel temperature sensor readings exceed 130° F, the system will shut off the affected channel, even if another sensor is reading below 40° F. The system will remain shut off until a power cycle or self-test is initiated at the heater box.

Additionally, if the system detects a heater fault on either channel, the affected channel will be automatically and entirely shutoff until repairs are made.

IV. Built in Test Function

No preflight check is required. However, system validation may be accomplished with the system's Built-In-Test (BIT) function.

A Press-To-Test (PTT) switch initiates a Built-In-Test procedure that checks the integrity of the controller and the corresponding heaters when pressed and held for approximately 2 seconds. The controller also performs a Power-On BIT (PBIT) and a Continuous BIT (CBIT) to ensure system integrity.

The LED indicators on the face of the control box allow a test of the system by manually pressing the Press-To-Test Switch and visually verifying the indicators for each heater are illuminated. The system is powered by the main direct current (DC) Power when the engines are running. To test the system prior to flight, power is provided by an auxiliary power unit (APU) or external power by means of an additional circuit.

V. STC Details

The Peregrine FAA STC, ST01075DE, certifies the fitting of heater components to each of the twelve (12) actuator devices, installation of a control module and cockpit switch/annunciator installation.

The installation process requires approximately three (3) weeks of downtime and a six (6) month lead time from order placement.

VI. Solution Pedigree

Gulfstream operates several 'Gulfstream Field and Airborne Support Teams (FAST)' G150 aircraft, Figure 4, to provide factory service for customers.

Figure 4: Gulfstream FAST G150

The FAST G150 aircraft encountered this flap/slat actuation issue and worked with Peregrine and their selected authorized repair station to develop a retrofit solution.

Peregrine answered the challenge and developed a complete STC solution that has subsequently been installed on the FAST aircraft.

While not a Service Bulletin from Gulfstream, the STC has been recognized by Gulfstream FAST operation as solving the issue with high lift actuation system freeze-up.

VII. For Further Information

Peregrine is ready to schedule your STC installation or delivery of the STC and installation package to your preferred repair station.

The STC and associated components are available directly from Peregrine.

Peregrine also offers a turnkey solution including labor, STC and project management for complete installation and return to service of your G150 at a Denver area FAA repair station familiar with this STC.

VIII. Contact:

PEREGRINE

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7385 S. Peoria Street Unit C4
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www.peregrine.aero

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Gulfstream G150 Flap/Slat Actuator Heater System STC

Frequently Asked Questions
Peregrine Avionics

Summary

Peregrine has developed an approved solution to resolve issues with the G150 flap and slat actuation systems that may arise during approach and landing in certain situations. When a G150 has been exposed to precipitation or high humidity, followed by exposure to freezing temperature at altitude, the flap and slat actuation drives can freeze, preventing the high lift devices from deploying.

How do I equip my G150 with this STC?

Peregrine can provide a complete STC and installation package to your preferred repair station. The STC and associated components are available directly from Peregrine.

Peregrine also offers a turnkey solution including labor, STC and project management for complete installation and return to service of your G150 at our selected Denver area FAA authorized repair station that is familiar with this STC.

Why did Peregrine develop this STC?

Gulfstream operates several 'Gulfstream Field and Airborne Support Teams (FAST)' G150 aircraft to provide factory service for customers.

The FAST G150 aircraft encountered this flap/slat actuation issue and worked with Peregrine and their selected authorized repair facility to develop a retrofit solution.

Peregrine answered the challenge and developed a complete STC solution that has subsequently been installed on the FAST aircraft.

What is added to my aircraft?

The G150 flap and slat drive system is composed of a Power Drive Unit (PDU), flexible drive shafts and twelve linear ball screw actuators (3 per wing, 2 systems).

The STC adds heater components to each of the twelve (12) actuator devices, a control module located in the fuselage, a cockpit switch/annunciator and associated bracketry and wiring. Figure 1 shows an overview.

The installed system weight totals less than 22 lbs. See Table 2.

How does this affect operation and maintenance of the aircraft and the flap/slat systems?

The STC does not modify the G150 Flap/Slat drive system including controls, indications, safety mechanisms or recommended lubrication maintenance procedures.

External supplemental heaters are added to existing components.

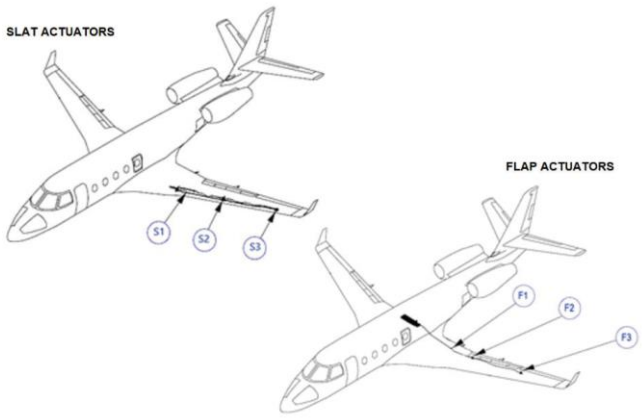

Figure 1: G150 Equipment Installation Locations, Left Wing Shown. STC does not modify the G150 Flap/Slat drive system including controls, indications, safety mechanisms or recommended lubrication maintenance procedures

Does the system provide freeze-up protection automatically?

The system will automatically heat the actuators when temperatures are below 40° F. Thermistors installed on each heater are used to both activate the heaters at the proper temperature and ensure the actuators never reach the upper operating temperature limit of 130° F.

What does the STC Cost?

Call or email Peregrine today for a price and schedule quotation to meet your aircraft or fleet requirements.

Can the STC be purchased from Peregrine and parts sourced by my installer?

The heaters and control system components are available exclusively through Peregrine as part of the STC.

Is there a Gulfstream Service Bulletin?

While not a Service Bulletin from Gulfstream, the STC has been recognized by Gulfstream FAST operation as solving the issue with high lift actuation system freeze-up.

Will my Gulfstream Service Center install this for me?

Yes, inquire with your Service Center for pricing and scheduling.

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What is involved in the installation of the system?

The flaps and slats are removed to access the drive system. Once the heaters (Figure 2), control modules and wiring (Figure 3) are installed, the flaps and slats are replaced and, if necessary, rigged in accordance with Gulfstream service procedures detailed in G150 ATA 100 documentation. (ATA 27-82-01, 27-80-00-AT, 27-51-05-RI, 27-50-00-AT).

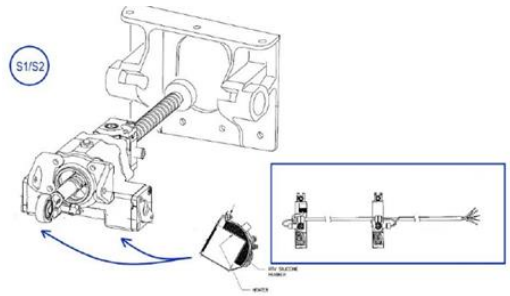

Figure 2: Wrap-around, cuff-style, design and are mounted on the exterior of the actuators

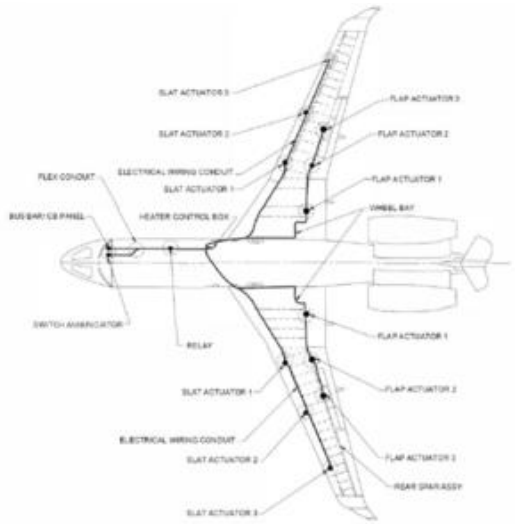

Figure 3: Wiring and component installation locations are described fully in the STC

Who can do this work?

The STC and associated components are available directly from Peregrine.

- ✓ Peregrine can deliver of the STC and installation package to your preferred repair station.
- ✓ Peregrine is ready to schedule the installation as a turnkey solution including labor, STC, project management and return to service of your G150 at our Denver area FAA repair station familiar with this STC.

When can I schedule my aircraft?

There is a nominal lead time for STC components.

The installation requires approximately three (3) weeks for installation at the Peregrine affiliated FAA Repair station.

Your repair station can provide their estimated completion time.

What are the power and weight considerations?

Table 1 shows electrical loads and Table 2 provides weight and balance information.

Table 1: In-Flight Electrical Bus Load changes due to Installed Equipment

Equipment	Left Distribution Bus Loading Increase	Left Generator and No 1 MAIN Bus Loading Increase	Right Distribution Bus Loading Increase	Right Generator and No 1 MAIN Bus Loading Increase
Flap Actuator Heaters	11.26 A	11.26 A	-	-
Slat Actuator Heaters	-	-	11.26 A	11.26 A

Table 2: G150 Weight and Balance Data

Location - Components (added)	Qty	Weight (lbs)	Arm (in)	Moment Arm (in-lbs)
Cockpit – Circuit Breakers, Annunciator, and Wiring	1	0.25	125.20	31.30
Right Cabin – Relay and wiring	1	1.10	233.62	256.98
Lower Fuselage – Control Box and mount	1	3.98	256.68	1021.59
Wings – 12 Heater assemblies	1	2.40	310.00	744.00
Wings and Fuselage -Wiring Install	1	13.62	288.00	3922.56
Total of STC System Install		21.35	279.93	5976.43

For further information:

Peregrine
7385 S. Peoria Street Unit C4
Englewood, CO 80112
+1 (303) 325-3873
www.peregrine.aero

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United States of America
Department of Transportation
Federal Aviation Administration

Supplemental Type Certificate

Number: ST01075DE

This certificate issued to: Peregrine
7385 S Peoria St, Unit C4
Englewood, CO 80112

Certifies that the change in the type design for the following product with the limitations and conditions therefore as specified hereon meets the airworthiness requirements of Part 25 of Federal Aviation Regulations.

Original Product Type Certificate Number: A16NM

Make: Gulfstream Aerospace LP

Model: G150

Description of Type Design Change:

Installation of Supplemental Flap/Slat Actuator Heater System in accordance with Document No. E-GS-20-0002, Master Drawing List, Flap/Slat Actuator Supplemental Heaters Gulfstream G150, Revision C dated 10/9/2020, FAA approved 11/2/2020 or later FAA approved revision. Instructions for Continued Airworthiness (ICA), Document No. E-GS-20-0008, Revision IR dated 10/9/2020, FAA Accepted 11/2/2020, or later FAA accepted revision are required to be made available at installation. FAA Approved Airplane Flight Manual Supplement, Document No. E-GS-20-0009, Revision IR dated 10/12/2020, FAA Approved 11/2/2020 or later FAA approved revision is required for this modification.

Limitations and Conditions:

1. The installer must determine whether this design change is compatible with previously approved modifications.
2. If the holder agrees to permit another person to use this certificate to alter a product, the holder must give the other person written evidence of that permission.

This certificate and the supporting data which is the basis for approval shall remain in effect until surrendered, suspended, revoked, or a termination date is otherwise established by the Administrator of the Federal Aviation Administration.

Date of Application: 09/03/2020

Date Reissued:

Date of Issuance: 11/02/2020

Date Amended:

By Direction of the Administrator

Signature:

Kreg R. Voorhies, ODA Lead administrator
Cert Works, LLC ODA
Title: ODA No. ODA(AIR)-833887-NM

Any alteration of this certificate is punishable by a fine of not exceeding $1,000, or imprisonment not exceeding 3 years, or both. This certificate may be transferred or made available to third persons by licensing agreements in accordance with 14 CFR 21.47. Possession of this Supplemental Type Certificate (STC) document by persons other than the STC holder does not constitute rights to the design data nor to alter an aircraft, aircraft engine, or propeller. The STC's supporting documentation (drawings, instructions, specifications, flight manual supplements, etc.) is the property of the STC holder. An STC holder who allows a person to use the STC to alter an aircraft, aircraft engine, or propeller must provide that person with written permission acceptable to the FAA. (Ref. 14 CFR 21.120).

United States of America
Department of Transportation
Federal Aviation Administration

Supplemental Type Certificate

Number: ST01075DE

INSTRUCTIONS: *The transfer endorsement below may be used to notify the appropriate FAA Aircraft Certification Office of the transfer of this Supplemental Type Certificate. The FAA will reissue the certificate in the name of the transferee and forward it to him.*

Transfer Endorsement

Transfer the ownership of Supplemental Type Certificate Number: _____

To *(Name and address of transferee):*

From *(Name and address of grantor):*

Extent of Authority (if licensing agreement):

Date of transfer:

Signature of grantor: _____

Any alteration of this certificate is punishable by a fine of not exceeding $1,000, or imprisonment not exceeding 3 years, or both. This certificate may be transferred or made available to third persons by licensing agreements in accordance with 14 CFR 21.47. Possession of this Supplemental Type Certificate (STC) document by persons other than the STC holder does not constitute rights to the design data nor to alter an aircraft, aircraft engine, or propeller. The STC's supporting documentation (drawings, instructions, specifications, flight manual supplements, etc.) is the property of the STC holder. An STC holder who allows a person to use the STC to alter an aircraft, aircraft engine, or propeller must provide that person with written permission acceptable to the FAA. (Ref. 14 CFR 21.120).

United States of America
Department of Transportation
Federal Aviation Administration

Supplemental Type Certificate

(Continuation Sheet)

Number: ST01075DE

Certification Basis:
Based on 14 CFR §§ 21.115 and 21.101, and the FAA policy for significant changes in FAA Order 8110.48, the certification basis for the Gulfstream Aerospace LP G150 Supplemental Flap/Slat Actuator Heater System installation is as follows:

a. The type certification basis for Gulfstream Aerospace LP G150 airplance as shown on TCDS A16NM for parts not changed or not affected by the change.

b. The certification basis for parts changed or affected by the change since the reference date of application, 9/3/2020, is based upon 14 CFR Part 25 as amended by amendments 25-1 through 25-108. Based on 14 CFR §§ 21.115 and 21.101, and the FAA policy for significant changes in FAA Order 8110.48, the certification basis for this modification was determined to be:

Regulations at the TCDS Certification Basis:
14 CFR Sections: 25.301 Amdt. 25-23; 25.303 Amdt. 25-23; 25.305(a)(b)(3) Amdt. 25-77; 25.307(a) Amdt. 25-72; 25.337(a)(b)(c) Amdt. 25-23; 25.561(c) Amdt. 25-23; 25.601 Amdt. - ; 25.603 Amdt. 25-46; 25.605(a) Amdt. 25-46; 25.607 Amdt. 25-23; 25.609 Amdt. - ; 25.611 Amdt. 25-23; 25.613 Amdt. 25-72; 25.619 Amdt. 25-23; 25.625 Amdt. 25-72; 25.671(c) Amdt. 25-23; 25.771(a) Amdt. 25-4; 25.773(a)(2) Amdt. 25-46; 25.777(a)(c) Amdt. 25-46; 25.853(a) Amdt. 25-83; 25.869(a)(4) Amdt. 25-72; 25.1301 Amdt. - ; 25.1309(a)(b)(d)(g) Amdt. 25-41; 25.1322(c)(d) Amdt. 25-38; 25.1351(a)(d)(1)(2) Amdt. 25-41; 25.1353(a)(b) Amdt. 25-42; 25.1357(a)(c) Amdt. - ; 25.1381 Amdt. 25-72; 25.1431 Amdt. - ; 25.1529 Amdt. 25-54; 25.1581 Amdt. 25-72

- - - - - END - - - - -

Any alteration of this certificate and/or the Type Certificate Data Sheet is punishable by a fine not exceeding $1,000, or imprisonment not exceeding 3 years, or both. This certificate may be transferred or made available to third persons by licensing agreements in accordance with Title 14 of the Code of Federal Regulations, part 21, section 21.47 (14 CFR 21.47). A transfer must be endorsed as provided on the reverse hereof. A Type Certificate holder who allows a person to use the Type Certificate to manufacture a new aircraft, aircraft engine, or propeller must provide that person with a written licensing agreement acceptable to the FAA. (Ref. 14 CFR 21.55).