ACE-99-09

U.S. Department of Transportation

Federal Aviation Administration

Memorandum

Subject: ACTION: Approval of Equivalent Level of Safety (ELOS) for a Single Power Lever for The New Piper Aircraft Model PA-46-400TP, Project No. AT2572AT-A

Date: JUL 2 0 1999

From: Manager, Project Support Branch, ACE-112

Reply to Attn. of: S.M. Nagarajan (816) 426-6932

To: Associate Manager, Atlanta Aircraft Certification Office, ACE-117A

Attached is the approved Equivalent Level of Safety (ELOS), P-1 Issue Paper, Stage 1, for project No. AT2572AT-A: The New Piper Aircraft, Inc. Model PA-46-400TP. The approval indicates our concurrence with the FAA position for a Single Power Lever, as stated in the issue paper.

for William J. Timberlake

Attachment

ISSUE PAPER

PROJECT: THE NEW PIPER AIRCRAFT, INC
Model PA46-400TP, Malibu Meridian
Project No. AT2572AT-A

REG.REF.: §§23.777 (a)(d), 23.779 (b) and 23.781 (b)

ITEM: P-1
STAGE: 1

DATE: May 6, 1999

NATIONAL POLICY REF.: None

ISSUE STATUS: Open

SUBJECT: Equivalent Level of Safety for a Single Power Lever

BRANCH ACTION: ACE-116A, ACE-117A, ACE-118A

COMPLIANCE TARGET: Pre-TC

EQUIVALENT LEVEL OF SAFETY

STATEMENT OF ISSUE: The New Piper Aircraft, Inc is requesting an Equivalent Level of Safety finding for §§23.777 (a)(d), 23.779 (b) and 23.781 (b). This finding is required because the regulations did not envision a single power lever and therefore does not provide sufficient flexibility to permit the certification of designs without separate power, propeller, and mixture controls.

BACKGROUND: The PA-46-400TP Malibu Meridian is a turbopropeller version of the Malibu PA-46 basic aircraft with new and modified powerplant and mechanical systems. One of those systems encompasses a novel engine control system which integrates the thrust or power control function with the condition function (which controls the fuel control unit). The FAR part 23 regulations listed below pertain to the traditional engine controls including power (or thrust), propeller and condition (for a turboprop) and hence cannot be applicable to a control system which uses only one lever as described herein.

The single power lever concept is not new and is used on aircraft with simplified control systems such as the Porsche powered Mooney, and various other aircraft which use an electronic engine control system, or FADEC. The system which The New Piper Aircraft, Inc. proposes to certify is a mechanical lever which separately engages either the power control function or the condition (fuel) control function to control the stop, run, full power through idle power, and beta and reverse power of the engine. When either the power function or the condition function is engaged, the function not being modulated is fixed in the last position that was selected. Two separate and distinct actions are required for the pilot to move the single power lever from either the condition function slot to the

power function slot or vice versa. The lever must be moved to the right or the left and at the same time a spring loaded "Tee" handle must be lifted to overcome a gate.

The following is a rationale addressing the proposed means of compliance to the applicable FARs and, where unable to meet the exact verbage of the FAR, a method to comply with the intent of the regulation:

23.777 Cockpit controls [Amdt. 23-51]

(a) Each cockpit control must be located and (except where it's function is obvious) identified to provide convenient operation and to prevent confusion and inadvertent operation.

The location of the single power lever is on the control pedestal in the center lower portion of the instrument panel similar to the existing engine control lever locations on other Piper aircraft. The single power lever will be identified as to its functionality via a lighted cover panel which surrounds two slots, oriented fore and aft, in which the lever moves (see figure 1). The left hand slot is the power or thrust slot and is the slot used to modulate engine torque for forward and reverse thrust when the lever is engaged in this slot. The right hand slot is the condition control slot and is used to modulate the condition function of the engine fuel control unit when the single power lever is engaged in the condition function slot.

Two separate and distinct actions are required for the pilot to move the single power lever from either the condition function slot to the power function slot or vice versa. The lever must be moved to the right or to the left and at the same time a spring loaded "Tee" handle must be lifted to overcome a gate.

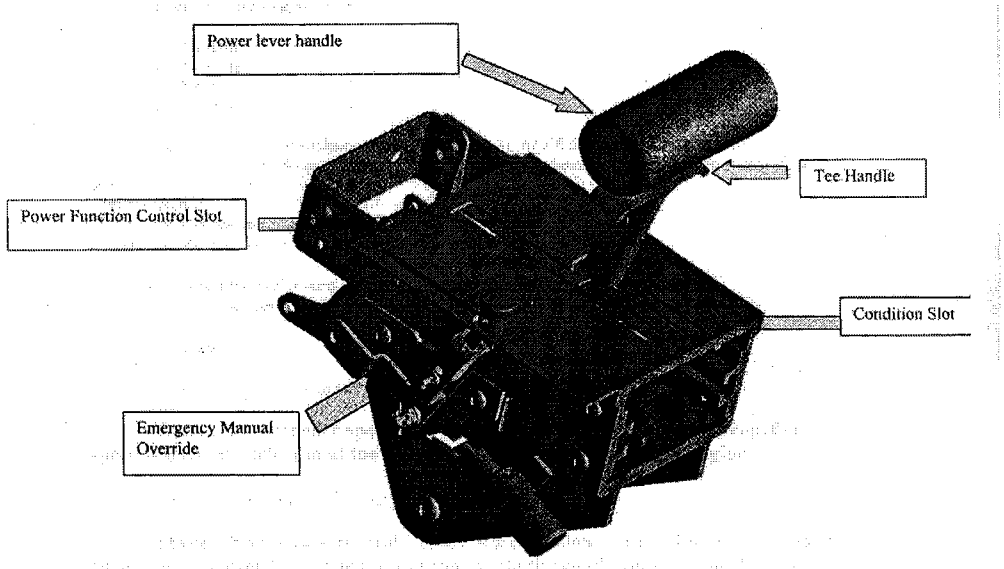

Figure 1

(d) The control location order from left to right must be power (thrust) lever, propeller (rpm control), and mixture control (condition lever and fuel cutoff for turbine-powered airplanes). Power (thrust) levers must be at least one inch higher or longer to make then more prominent that propeller (rpm control) or mixture controls. Carburetor heat or alternate air control must be to the left of the throttle or at least eight inches from the mixture control when located other than on a pedestal. Carburetor heat or alternate air control, when located on a pedestal must be aft or below the power (thrust) lever. Supercharger controls must be located below or aft of the propeller controls. Airplanes with tandem seating or single-place airplanes may utilize control locations on the left side of the cabin compartment; however, location order from left to right must be power (thrust) lever, propeller (rpm control) and mixture control.

The control location order from left to right is not applicable because there is only one lever (single power lever) as opposed to a power lever, propeller lever and condition lever. The propeller lever is not required because the propeller governor is fixed to provide a constant 2000-rpm propeller speed. The power function slot location of the single power lever is the left-hand slot and the condition function slot is the right-hand slot, which complies with the intent of the regulation.

23.779 Motion and effect of cockpit controls [Amdt 23-51]

(b) Powerplant and auxiliary controls:
(1) Powerplant controls:
Propellers — Forward to increase rpm

There is no propeller speed control knob in the Meridian. The propeller speed is fixed at 2000 rpm at the propeller governor located on the engine.

Mixture — Forward or upward for rich

There is no mixture control. There is a condition control, which is provided by the single power lever when it is engaged into the condition function slot to the right of the power slot. Movement of the lever forward in the condition function slot increases fuel flow from the cutoff position to the "run" position, which coincides with the idle power position. Movement of the lever aft in the condition function slot decreased fuel flow from the idle to the "stop" or cutoff position.

23.780 Cockpit control knob shape [Amdt. 23-33]

(b) Powerplant control knobs must conform to the general shapes (but not necessarily the exact sizes or specific proportions) in the following figure:

The single power lever cannot comply with a dual knob shape because it uses only one knob of the power (thrust) shape. The purpose of having

different shaped knobs for different functions is to ensure that the pilot does not mistakenly move the unintended control lever. The design of the single power lever will incorporate features which will insure that the lever movement is distinct from a given control function. The design of the single power lever will incorporate features, which insure that the pilot can grab the lever and determine the control function by the distinct movement without requiring visual observation and verification of lever location.

Figures 2 through 7 depict typical operation of the single power lever.

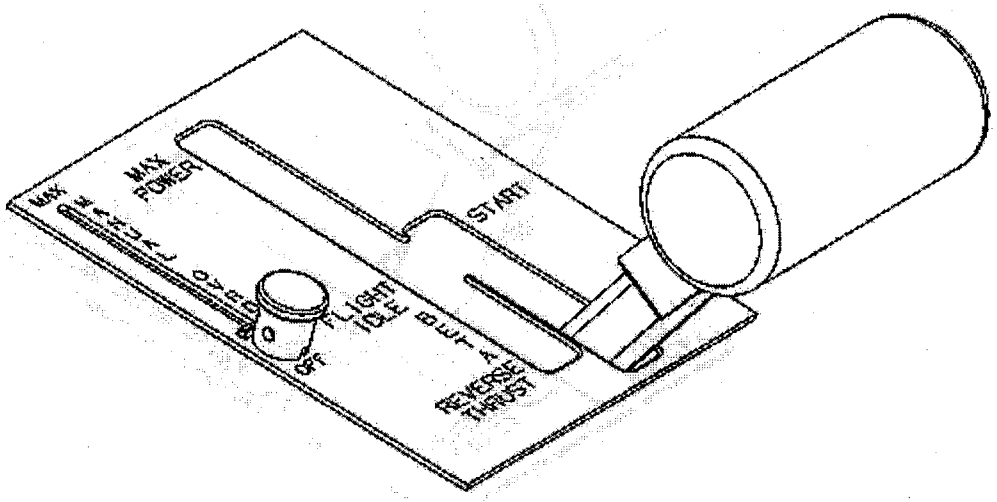

Figure 2
Stop Position

Function	**State**
Condition	Fuel Cut-off (detented)
Power	Idle (locked)
Feather Switch	ON Feather
Reverse Lockout	Energized to allow beta/reverse (only with weight on wheels)
Auto Ignition	ON (when in auto-ignition and engine torque <275 lb-ft)

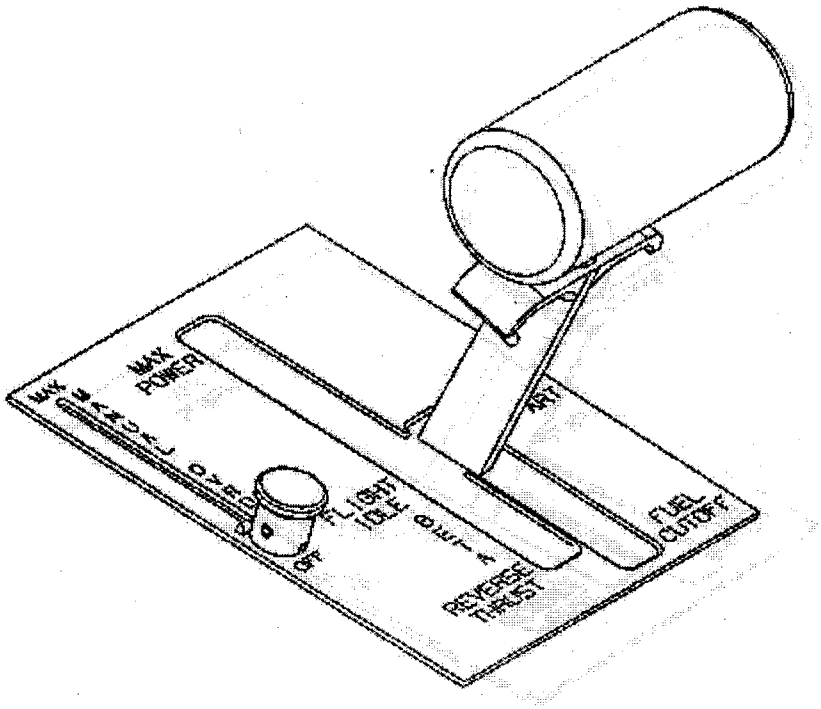

Figure 3
Start Position

Function	**State**
Condition	Idle (detented)
Power	Idle (locked)
Feather Switch	OFF (Normal, unfeathered)
Reverse Lockout	Energized to allow beta/reverse (only with weight on wheels)
Auto Ignition	ON (when in auto-ignition and engine torque <275 lb-ft)

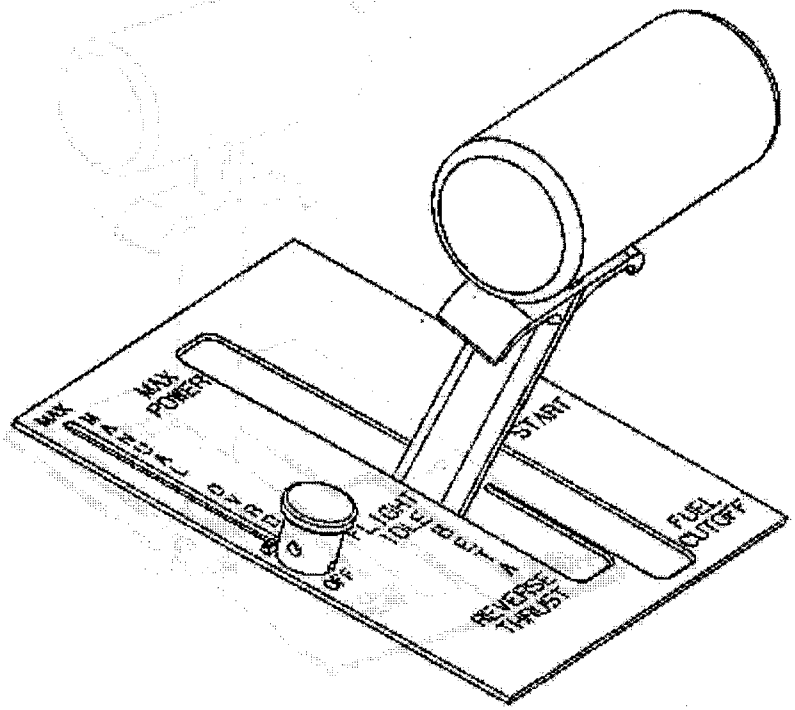

Figure 4
Idle Power Position

Function	**State**
Condition	Idle (locked)
Power	Idle (detented)
Feather Switch	OFF (Normal, unfeathered)
Reverse Lockout	With weight on wheels: Energized to all beta/reverse; Without weight on wheels: De-energized to prevent beta/reverse in-flight
Auto Ignition	ON (when in auto-ignition and engine torque <275 lb-ft)

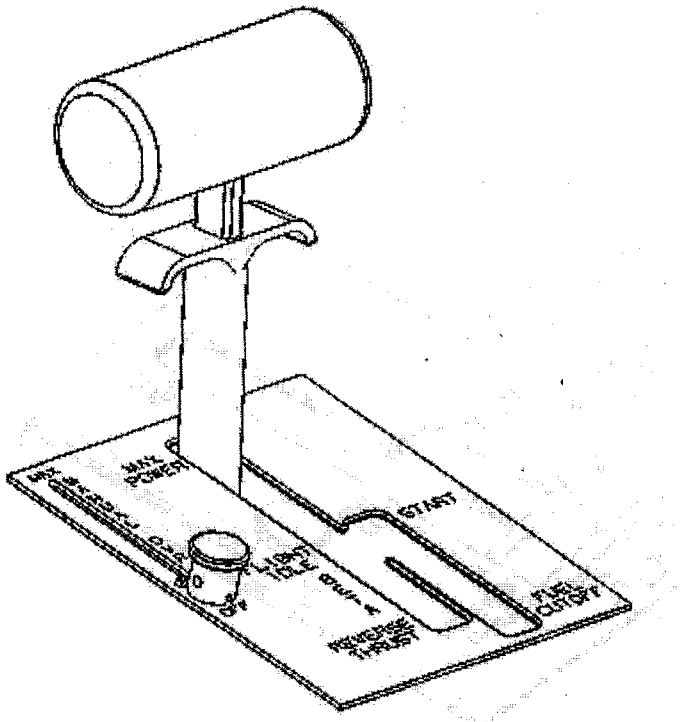

Figure 5
Power Modulation

Function	**State**
Condition	Idle (locked)
Power	Pilot positioned
Feather Switch	OFF (Normal , unfeathered)
Reverse Lockout	De-energized to prevent beta/reverse in-flight (without weight on wheels)
Auto Ignition	ON (when in auto-ignition and engine torque <275 lb-ft)

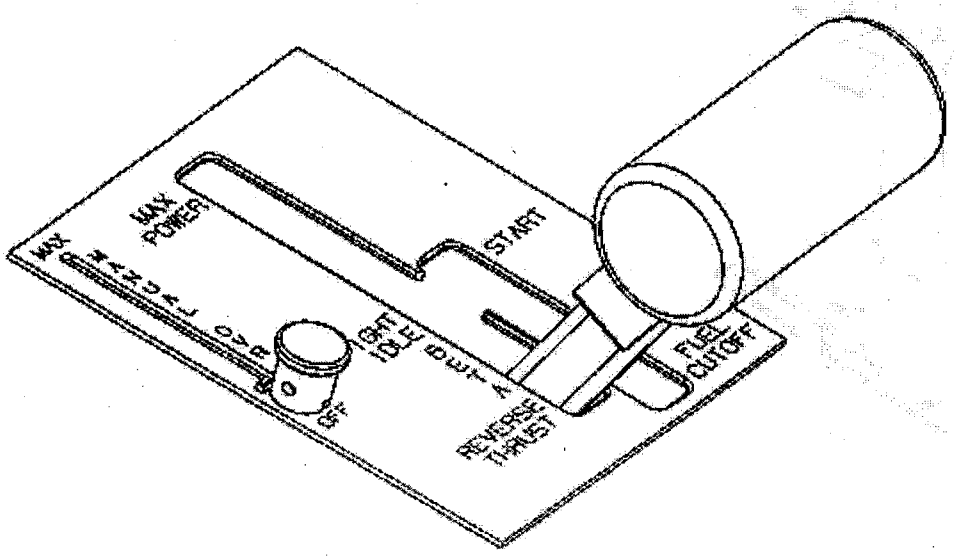

Figure 6
Beta and Reverse Position

Function	**State**
Condition	Idle (locked)
Power	Positioned over gates
Feather Switch	OFF (Normal, unfeathered)
Reverse Lockout	With weight on wheels: Energized to allow beta/reverse
Auto Ignition	ON (when in auto-ignition and engine torque <275 lb-ft)
Beta Position Switch	ON (illuminates BETA annunciator)

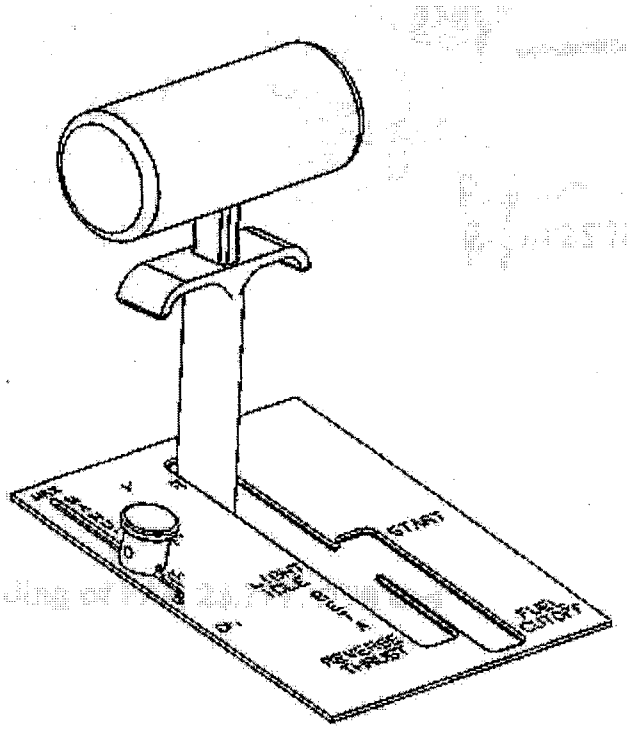

Figure 7
Manual Override Modulation

Function	**State**
Condition	Idle (locked)
Power	Pilot positioned
Feather Switch	OFF (Normal, unfeathered)
Reverse Lockout	With weight on wheels: Energized to all beta/reverse; Without weight on wheels: De-energized to prevent beta/reverse in-flight
Auto Ignition	ON (when in auto-ignition and engine torque <275 lb-ft)

PROJECT: THE NEW PIPER AIRCRAFT, INC
Model PA46-400TP
Project No. AT2572AT-A

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FAA POSITION: The FAA recognizes that the concept of a single power lever in lieu of separate power, mixture, and propeller controls was not envisioned when the regulations were established. The New Piper Aircraft, Inc. design is considered to meet the intent of the regulations by virtue of the use of the lever to perform only one function at a time and use of separate slots, which are arranged per the regulations, for each function. This design provides the desired commonality of engine/fuel/propeller control location with respect to each other and to other aircraft.

FCAA POSITION: None

APPLICANT POSITION:

CONCLUSION: The FAA has considered the design and concurs that the design, while not complying with the letter of the regulations, meets the intent of the regulations. A finding of Equivalent Safety against §§23.777 (a)(d) [Amdt. 23-51], 23.779 (b) [Amdt. 23-51], and 23.781 (b) [Amdt. 23-33] is made for The New Piper Aircraft, Inc PA46-400TP, Malibu Meridian.

The Issue Paper is considered closed.

Manager, Small Airplane Directorate
Airplane Certification

7/19/99
Date

PROJECT: THE NEW PIPER AIRCRAFT, INC
Model PA46-400TP
Project No. AT2572AT-A

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