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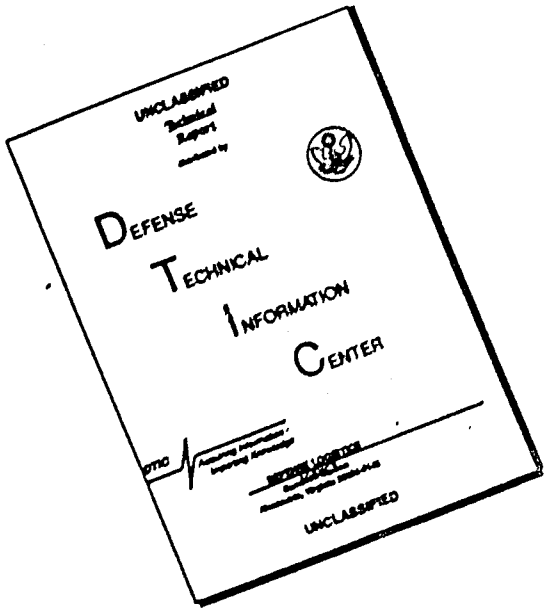

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SAWC-TDR-63-26

Evaluation of Geiss Anti-Groundloop Landing Gear on Cessna 01-E (L-19) Aircraft

SAWC Technical Documentary Report No. SAWC-TDR-63-26

DECEMBER 1963 • ICAG Project 2F-13

1st Combat Applications Group

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KEYWORD LIST

Listed below are keywords which serve as an index to the contents of this report (AFR-80-29).

Observation, C1-E
Groundloop
Landing Gear

SAWC-TDR-63-26 December 1963

Evaluation of Geiss Anti-Groundloop Landing
Gear on Cessna 01-E (L-19) Aircraft

PREPARED BY: H. J. Carlile
H. J. CARLILE
Capt, USAF
Project Officer

APPROVED BY: Raymond R. Stewart
RAYMOND R. STEWART
Lt Col, USAF
Director of Operations

APPROVED BY: William A. Kruge
WILLIAM A. KRUGE
Colonel, USAF
Commander

FOREWORD

This evaluation of the Ceiss anti-groundloop landing gear on the Cessna 01-E aircraft was conducted by direction of the Commander, 1st Combat Applications Group, under 1CAG Project No. 2F-13. The equipment used in this evaluation was furnished and installed by the Cessna Aircraft Company, Wichita, Kansas. The evaluation was conducted at Eglin AFB, Florida, Hurlburt Field, Florida, and Saufley Auxiliary Field 8A, Pensacola, Florida, in October and November 1963. Support for this project was provided by the Air Proving Ground Center under APGC Project 9076T-46-1. Major Robert Wood, Captain Rhein, Jr., and Captain David Krebs, First Air Commando Wing Instructor Pilots, participated in demonstrations performed during this project.

ABSTRACT

This evaluation was initiated to determine the effectiveness of the Geiss anti-groundloop landing gear on the Cessna 01-E (L-19) aircraft. This gear is designed to assist pilots in preventing groundloops and to reduce the amount of aircraft damage when groundloops occur.

Three-hundred takeoffs and landings were made with a Cessna 01-E aircraft equipped with the Geiss landing gear. Poor pilot techniques were intentionally utilized to simulate student operation. One-half of the landings were made on sod runways and the other half were accomplished on concrete runways. On 250 landings proper recovery techniques were utilized when groundloops became imminent. No inadvertent groundloops occurred.

Fifty intentional groundloops were performed. One-half of the groundloops were accomplished on concrete runways and one-half were performed on sod runways. The airspeed at groundloop inception was 35 MPH IAS or below. The aircraft was not allowed to leave the smooth landing area. The aircraft equipped with the Geiss gear did not sustain any major damage during these 50 groundloops.

Use of the Geiss gear did not induce any detectable aircraft handling problems, either in flight or on the ground.

The complete Geiss gear installation weighs less than eight pounds and the cost of the item, as quoted by the contractor at the time of this evaluation, was approximately $250 per aircraft.

This landing gear modification does provide the functions for which it was designed.

CONTENTS

ILLUSTRATIONS

PART I - INTRODUCTION

The Cessna 01-E aircraft reportedly has had an exceptionally high accident rate. The large majority of accidents occur during landing or takeoff due to the ground-handling characteristics of the aircraft. A high accident rate was evident in USAF SAWC operations and further investigation disclosed the U.S. Army experienced a similar high accident rate with this aircraft. (Reference Items 1 and 3, Bibliography.)

Informal inquiry at the Cessna Aircraft Company resulted in a suggestion by Cessna personnel that equipping the 01-E aircraft with a special landing gear, known as the Geiss* anti-groundloop landing gear, might serve as a means for reducing damage to this aircraft.

The Geiss anti-groundloop landing gear consists of aircraft main gear axles which are designed to caster the main wheels outward within small limits. The gear acts to turn the outside wheel away from the direction of an incipient groundloop, thereby introducing a stabilizing component which acts to prevent the groundloop from occurring. The gear is readily interchangeable with standard gear and is only about eight pounds heavier than the standard components. It can be installed on an 01-E aircraft for approximately $250. This type of gear is currently in use on several types of civilian light planes. A detailed description of the gear is presented in Part III, page 2.

The gear was installed at their Wichita Plant by Cessna personnel. A Cessna test pilot conducted taxi checks and made one test flight at Wichita. The aircraft was then ferried back to Hurlburt Field for evaluation by personnel of the 1st Combat Applications Group.

It should be noted that this was not a development project. No investigation was made as to optimum spring tension, optimum hydraulic cylinder orifice size, optimum wheel turn angle, the effects of tire pressure, or the effects of runway coefficient of friction, and precise

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* Originally Geisse, the name of the inventor of this device; however, the name of his company has been changed to Geiss. This accounts for spelling differences in literature and correspondence in which this equipment is mentioned.

measurements of rates of angular rotation were not made. It was assumed that the contractor had optimized these functions. No comparative tests were made on aireraft without the Geiss installation, due to the probability that the tests would cause major damage to the aircraft.

The U.S. Army evaluated a similar model of the Geiss gear as a crosswind landing aid in 1953; however, the device was not evaluated as an aid in preventing groundloops. (Reference Item 2, Bibliography.)

PART II - PURPOSE OF THE EVALUATION

The purpose of this project was to determine qualitatively the desirability of use of the Geiss anti-groundloop landing gear on the Cessna 01-E aircraft and to recommend maximum crosswind components to be allowed for student training and for normal operations on aircraft equipped with this gear.

The specific objectives of the evaluation were to:

1. Determine if the Geiss gear will reduce or prevent groundloops.

2. Determine if the gear will reduce aircraft damage resulting from groundloops.

3. Determine if the gear introduces any unsafe or undesirable characteristics under normal operations.

PART III - DESCRIPTION OF THE EVALUATION ITEM

The Geiss anti-groundloop device (Fig. 1) consists of a system for allowing individual main gear wheels to turn outboard up to 30° from the fuselage referenee line. Turning is opposed by the foree of a spring which exerts 20 pounds of restraint and by a small self-contained hydraulie cylinder with a floating piston eontaining a fixed orifice. (See Figs. 2 and 3.) The hydraulie piston is used as a damper to prevent undesirable oscillations and excessively rapid motion.

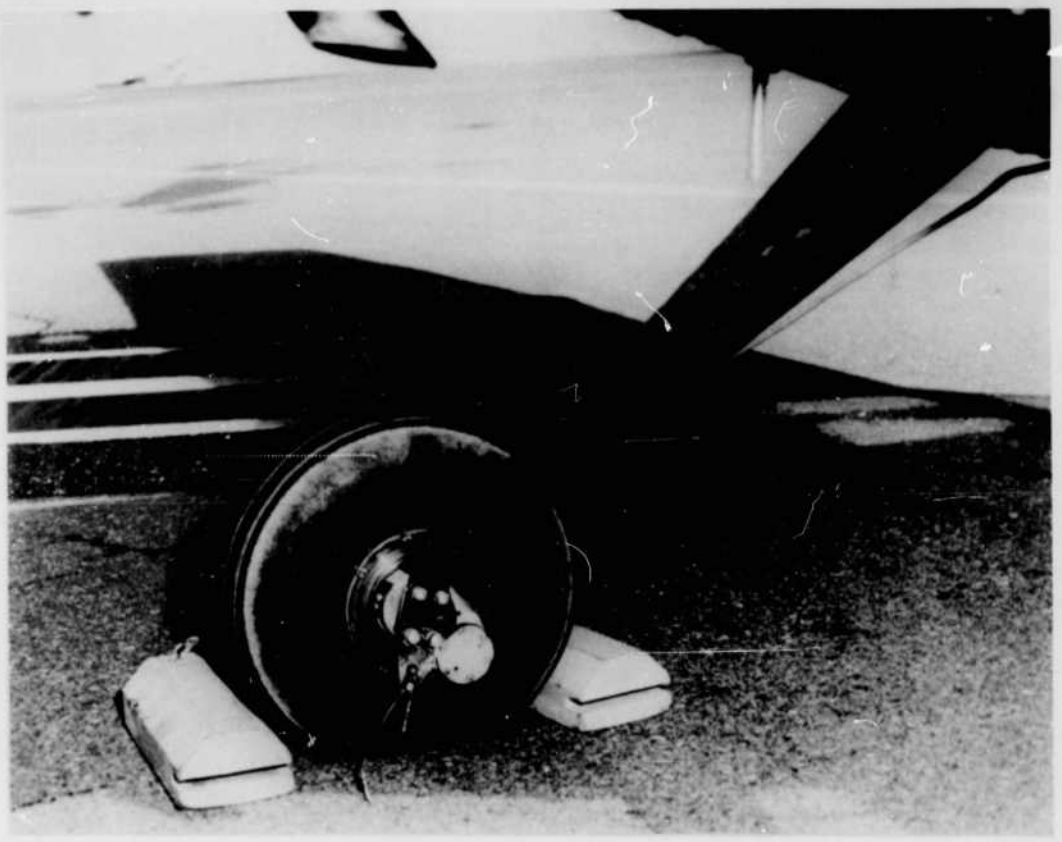

Fig. 1: Right Main Landing Gear of Cessna 01-E Aircraft Showing Geiss Anti-Groundloop Device Installed.

The installation of a Geiss kit can be made in approximately four man-hours with no special tools required. No direct pilot control is required as action is completely automatic.

The operation of the Geiss gear is relatively simple. (See Fig. 4, Part A.) The gear is pivoted in such a manner that sideward motion, as at the inception of a groundloop, puts a turning force on the wheel. The wheel turns in the direction of the desired landing path, which assists in keeping the aircraft from turning further. If the turning force is overwhelming, the turned wheel exerts an outboard force on the spring steel strut, bending the strut farther from the fuselage instead of allowing it to be tucked under the aircraft. (See Fig. 4, Part B.) The Geiss gear thus aids the pilot in recovery from incipient groundloops and, if the groundloop is not stopped, the gear keeps the spring strut

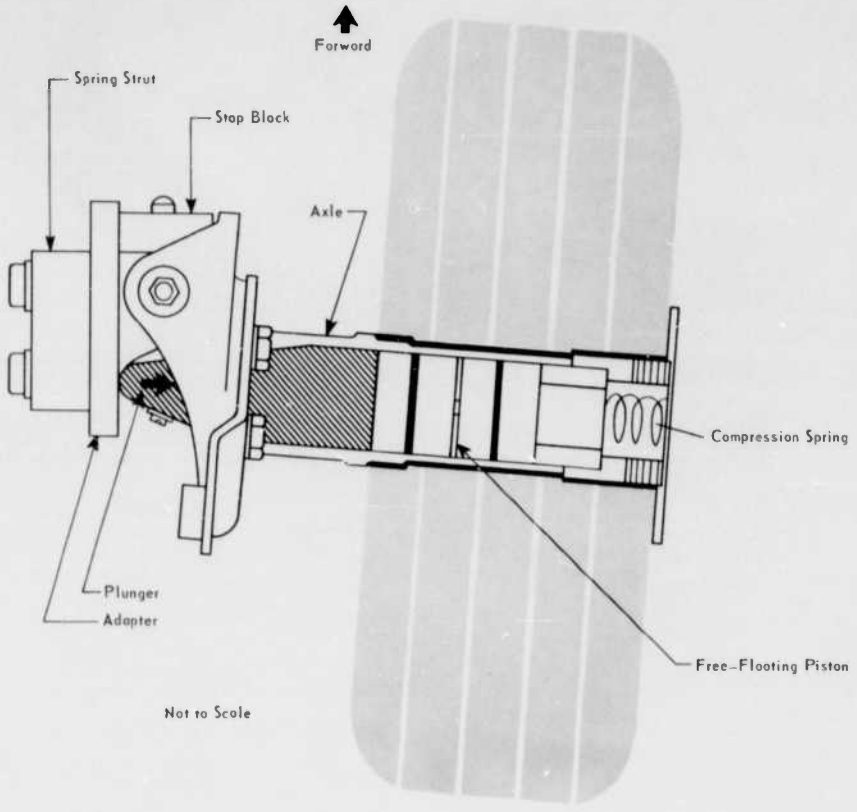

Fig. 2: Geiss Gear Mechanism (From Above).

bent away from the fuselage, thereby countering the overturning movement. (See Fig. 4, Part B.)

The Geiss gear does not function and has no effect on operations until the groundloop has progressed to a point where strong sideward loads are imposed on the wheels. The gear will not prevent all groundloops; however, it will assist pilots in recovery after a groundloop has started to develop and eliminates the damage normally associated with groundloops on this aircraft. Shown in Fig. 5 is a Cessna 01-E aircraft, equipped with the Geiss landing gear, which has sustained 50 groundloops. Fig. 6 illustrates damage which is frequently incurred in Cessna 01 aircraft equipped with standard landing gear.

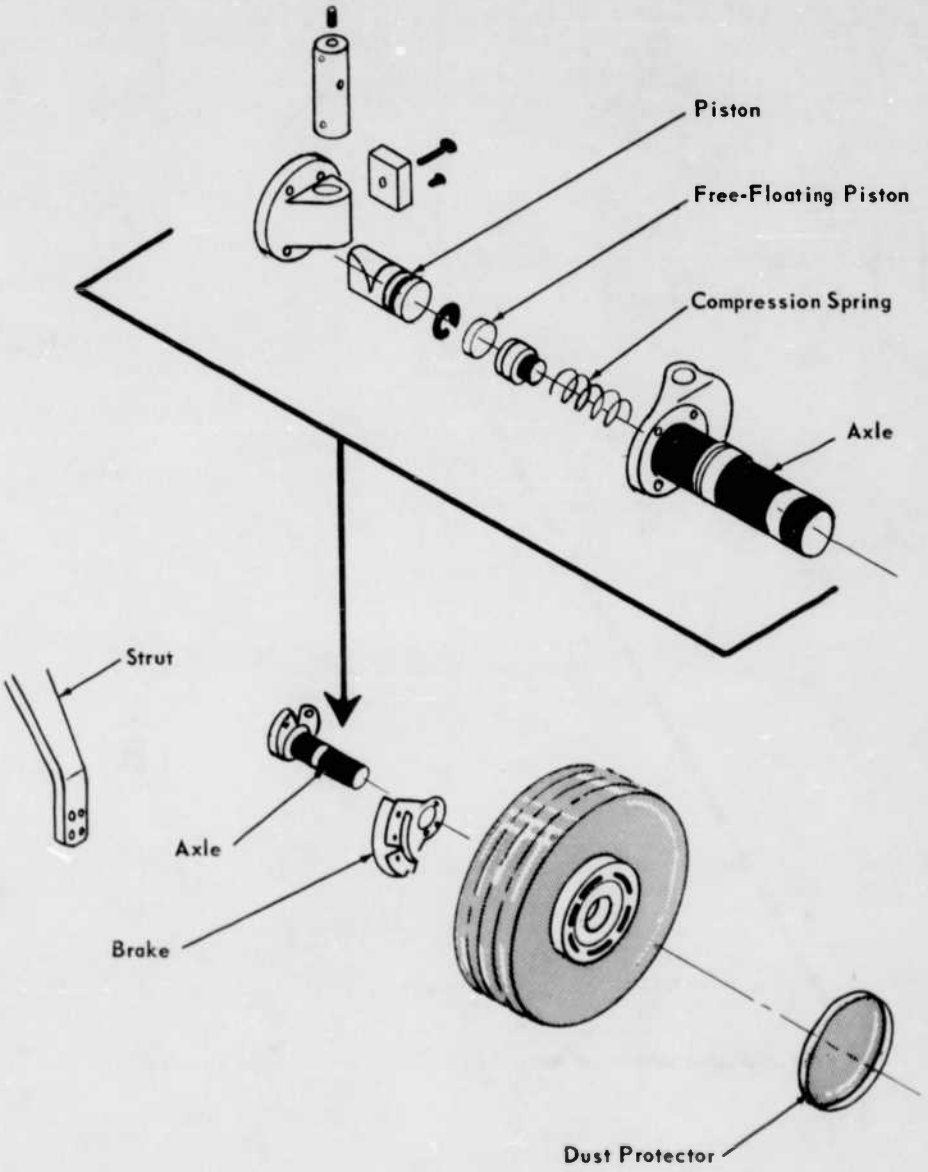

Fig. 3: Exploded View of Geiss Gear.

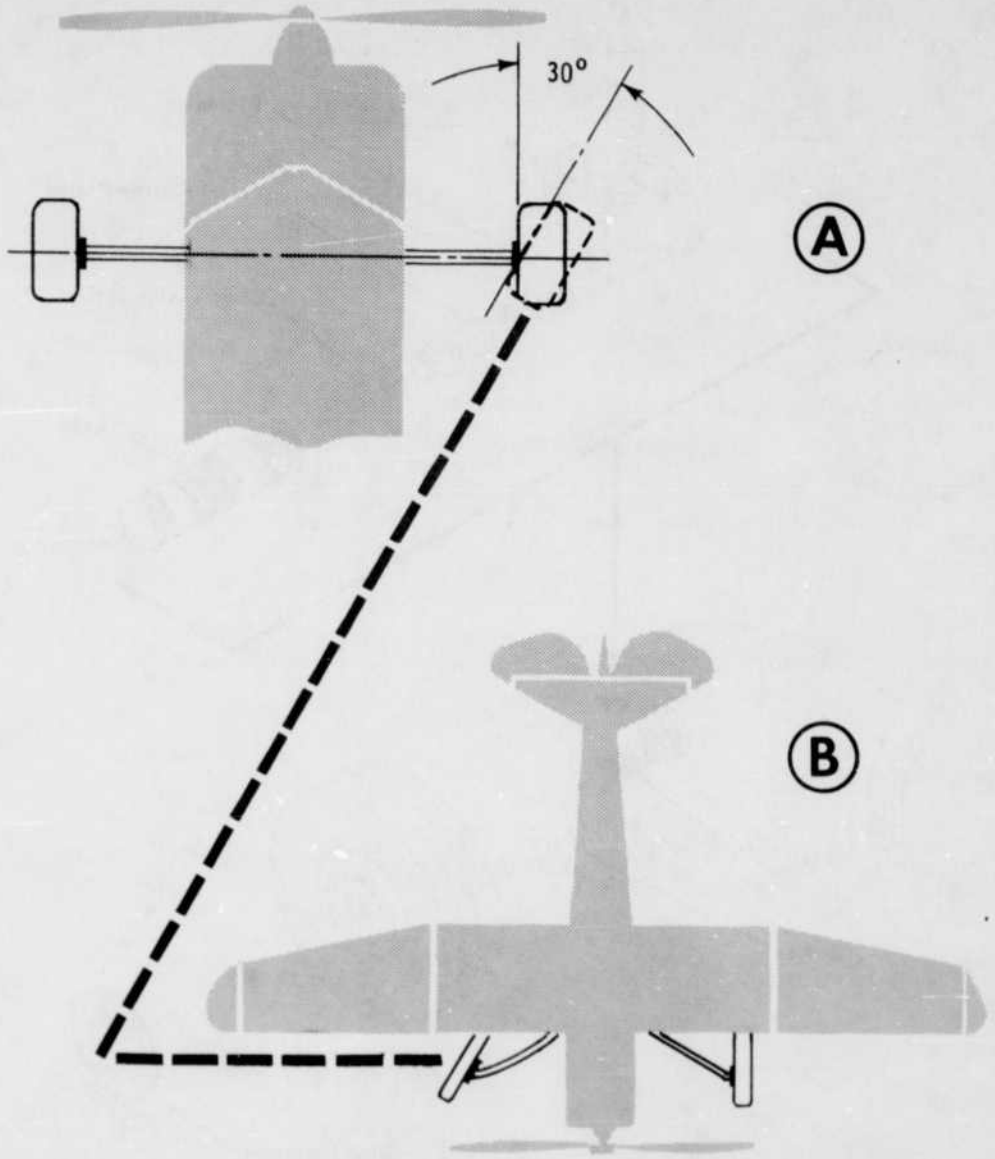

Fig. 4: Functional Drawing of Geiss Gear: (A) View Showing Angle of Turn of Gear Wheel; (B) View Showing Bent Right Strut Due to Force Exerted by Wheel in Turned Position.

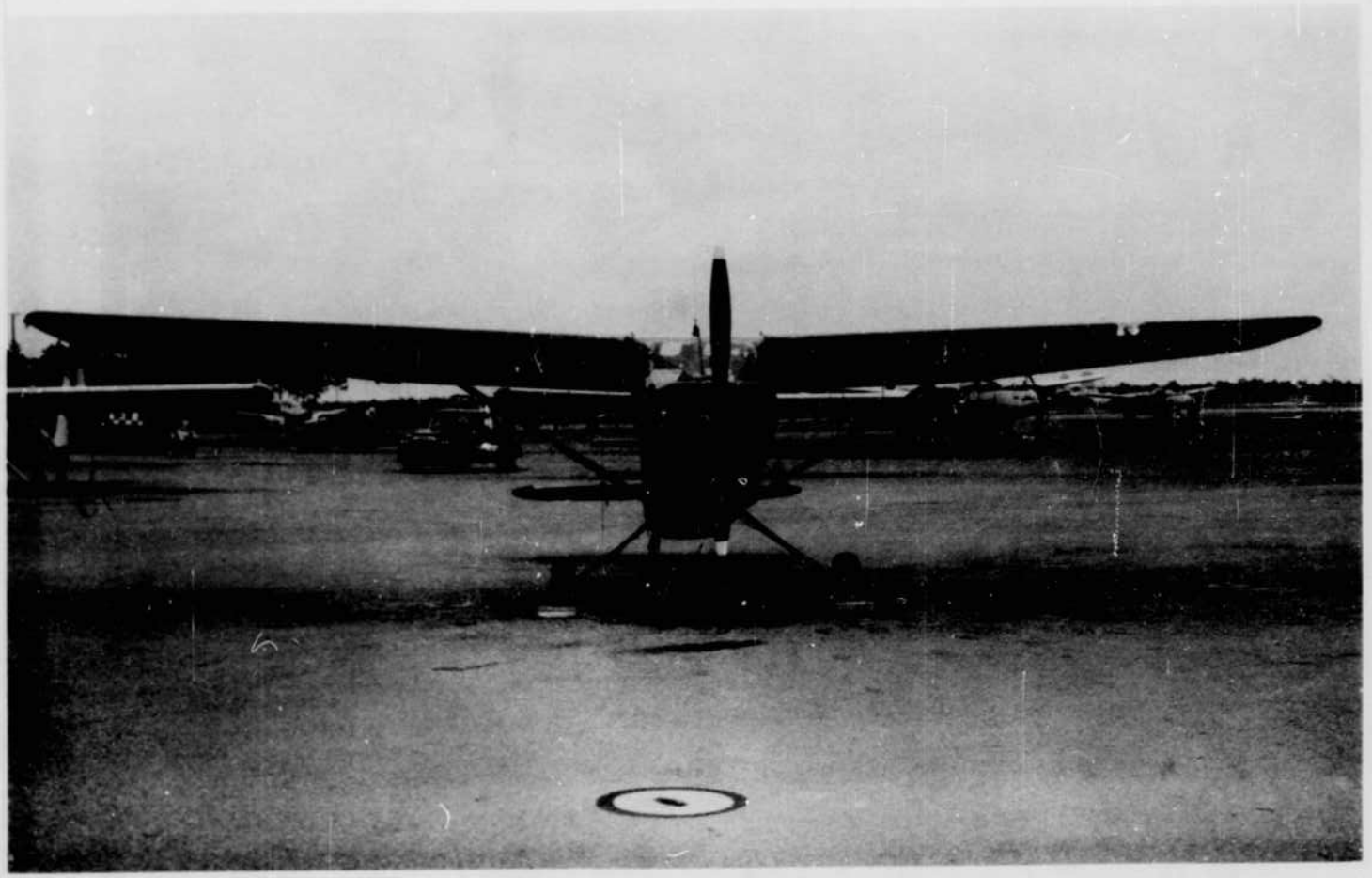

Fig. 5: Cessna O1-E Aircraft, Equipped with Geiss Landing Gear, After 50 Groundloops.

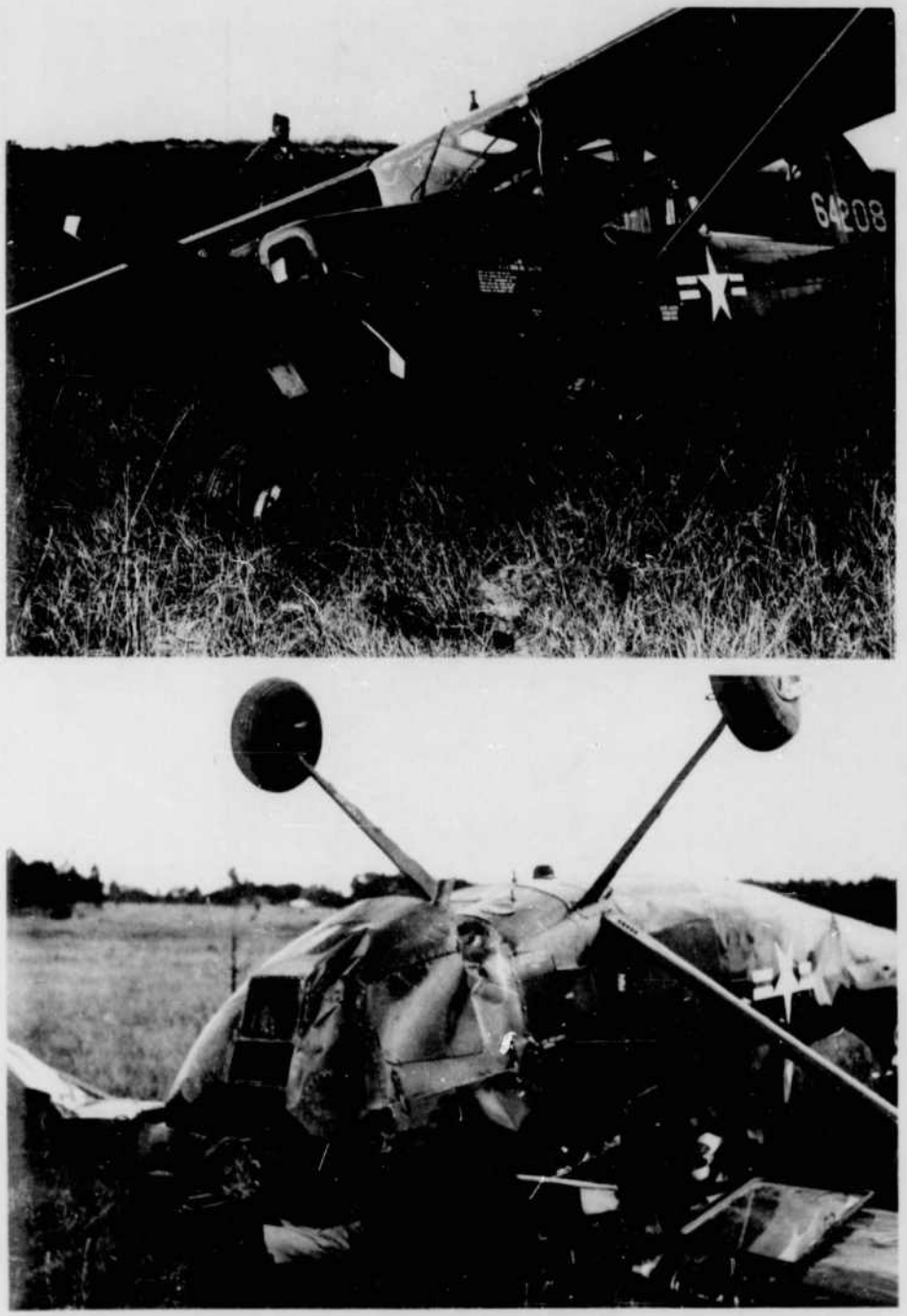

Fig. 6: Typical Groundloop Damage Incurred in Cessna 01 Aircraft Equipped with Standard Landing Gear.

PART IV - INSTRUMENTATION

No instrumentation was utilized in this evaluation; however, a 16mm motion picture camera was mounted on a fuselage boom to photograph the action of the landing gear and a ground 35mm motion picture camera was used to record aircraft movement.

PART V - EVALUATION PROCEDURES AND RESULTS

In the evaluation conducted by the 1st Combat Applications Group, 125 landings were made on sod runways, intentionally utilizing poor pilot techniques. These included using full flaps in strong crosswinds, allowing crab on touchdowns, making touchdowns at improper airspeeds and attitudes, and failing to hold the control stick full back during landings. When groundloops started to occur, proper recovery techniques were utilized. No inadvertent groundloops occurred on the aircraft equipped with the Geiss gear.

Following the landings made on sod runways, 125 landings were accomplished on concrete runways, intentionally utilizing similar poor landing techniques and proper recovery techniques. No inadvertent groundloops occurred.

Twenty-five intentional groundloops were then performed on concrete runways. No aircraft damage was incurred, except that the aluminum wheel flanges were broken on one occasion when the tire was pulled sideways until it was nearly off the wheel. The tire did not lose air and the aircraft was taxied normally to the parking area. The aircraft wings remained nearly level during the groundloops and there was no contact of the wingtips with the ground.

Twenty-five intentional groundloops were then performed on sod runways. No aircraft damage occurred.

Actual groundloops were not demonstrated above 35 MPH IAS. It is believed that sufficient rudder power is available above this speed to enable all but the most careless pilots to prevent groundloops.

The aircraft was dived to limit airspeed to determine that the wheels would not turn under air loads and induce in-flight problems. No wheel deflection occurred.

The aircraft was taxied into deep sand until it became completely stuck. The Geiss gear did not turn during the taxiing or cause any problems that would not occur on an aircraft with standard landing gear. The test aircraft was then taxied on a moderate slope. The gear did not turn or cause any ground-handling problem.

During the evaluation the Geiss landing gear was demonstrated for the U.S. Army Aviation Board at Fort Rucker, Alabama, and for the U.S. Army Department of Primary Fixed Wing Training at Shell AAF, Alabama.

In addition to the project officer, three pilots of the 1st Combat Applications Group flew orientation flights during this evaluation.

PART VI - CONCLUSIONS

1. The Geiss anti-groundloop gear functions as designed when installed on a Cessna 01-E aircraft.

2. The Geiss gear probably will reduce groundloop damage to the Cessna 01-E aircraft.

3. The Geiss gear is compatible with normal aircraft operations. Its use did not introduce abnormal problems when the aircraft was dived to limit speed or operated in deep sand or on slopes.

4. Use of the Geiss gear does not result in unsafe or undesirable aircraft characteristics.

5. Due to the reduction in the danger from groundloops during operations with aircraft equipped with the Geiss gear, student dual and solo transition training could be safely conducted with maximum allowable crosswind components increased 5 knots over present limits.

6. This gear should be equally effective on all Cessna 01 series aircraft.

7. The features of this gear should be equally applicable to other light aircraft having similar landing gear geometry.

PART VII - RECOMMENDATION

It is recommended that the Geiss anti-groundloop landing gear be installed on all Cessna 01 aircraft.

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