Exemption No. 9960

UNITED STATES OF AMERICA
DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION
KANSAS CITY, MO 64106

In the matter of the petition of **SPECTRUM AERONAUTICAL, LLC** for an exemption from Title 14 CFR Part 23, § 23.473, 23.477, 23.479, 23.481, 23.483, 23.493, 23.723, 23.725, 23.726, 23.727 and C23.1, Appendix C of Title 14, Code of Federal Regulations	**Regulatory Docket No. FAA-2009-0325-E**

GRANT OF EXEMPTION

By letters dated March 24, 2009 and October 12, 2009, Ms. Elizabeth Williams, Certification Manager, Spectrum Aeronautical, LLC, 303 West 3000 North, Spanish Fork, UT 84660 petitioned the Federal Aviation Administration (FAA) on behalf of Spectrum Aeronautical, LLC, for an exemption from §§ 23.473, 23.477, 23.479, 23.481, 23.483, 23.493, 23.723, 23.725, 23.726, 23.727, and C23.1, Appendix C of Title 14, Code of Federal Regulations (14 CFR). The proposed exemption, if granted, would allow the Spectrum Aeronautical, LLC Model S-40 to adhere to ground load conditions required by a 14 CFR part 25 design basis.

The petitioner requests relief from the following regulations:

Sections 23.473, 23.477, 23.479, 23.481, 23.483, 23.493, 23.723, 23.725, 23.726, 23.727, and C23.1, Appendix C of Title 14, Code of Federal Regulations.

These sections pertain to landing gear loads and associated airframe loads. If this petition is granted, it would permit these airplanes to be certificated with parallel rules of Title 14 CFR part 25.

The petitioner supports its request with the following information:

The petitioner states:

“Rationale:

“14 CFR Part 23 certification criteria were created for aircraft that will be flown by ab-initio and recreational pilots whose skill levels are lower than those of a professional pilot. These aircraft may be operated from rough unprepared runways. It is assumed that Part 23 aircraft land in a fully stalled condition. In contrast, aircraft certified under 14

CFR 25 are operated by type rated professional pilots and are typically flown onto the runway. All of these considerations imply that the ground loads found in 14 CFR 23 must be conservative. It is for this reason that 14 CFR 25 specifies the use of 1g wing lift relief as opposed to 14 CFR 23 which stipulates the use of 2/3g wing relief. Spectrum Aeronautical, LLC is petitioning to be allowed to use 1g wing lift relief as compared to 2/3g wing relief to reduce landing loads and hence lighten the landing gear and the adjoining aircraft structure."

"Equivalent Level of Safety:

"Pilots who fly the S-40 will be required to be type rated on the aircraft ensuring that their knowledge, experience and skills are equivalent to those of a crew flying a Transport Category aircraft. The S-40 will be operated from paved runways. Combining these facts with the ground load requirements of 14 CFR 25 will ensure that an equivalent level of safety exists with the ground load requirements of 14 CFR 23. The proposed loads are more appropriate for a jet aircraft of this class as has been acknowledged already by the FAA in granting similar exemptions."

"Public Interest:

"The public interest will be served if this exemption is granted because it will enable Spectrum to reduce the weight of the landing gear and its associated structure. This weight reduction will mean that less fuel will be needed to fly a given payload on a typical mission. The savings in fuel will reduce operating costs and exhaust emissions. Spectrum estimates that it could save at least 24 pounds in the weight of the landing gear and the associated structure if it can use the 1g wing lift relief provided for in 14 CFR 25 as opposed the 2/3g wing relief allowed for in 14 CFR 23. A 24 pound reduction per aircraft can provide a 0.73 pound fuel savings over a typical Model S-40 flight. Based on an estimated business jet usage of approximately 800 flights per year, this corresponds to an estimated annual fuel savings of 580 pounds per aircraft. With a conservatively estimated fleet size of 362 aircraft over the next decade, this would yield an overall fuel savings of 209,960 pounds per year."

"Spectrum Aeronautical, LLC proposes, in the public interest and to ensure a level of safety equal to that provided by the rule, that the requested exemption to Sections 23.473, 23.477, 23.479, 23.481, 23.483, 23.493, 23.723, 23.725, 23.726, 23.727, Appendix C23.1, through Amendment 23-57 of Title 14 of the Code of Federal Regulations include the following requirements instead of those listed above:

EXISTING 14 CFR 23 REQUIREMENTS	PROPOSED REQUIREMENT	DELTA BETWEEN REGULATION AND PROPOSAL	MITIGATION OF DELTA
Sec. 23.473	Ground load conditions and assumptions.		
(a) The ground load requirements of this subpart must be complied with at the design maximum weight except that Secs. 23.479, 23.481, and 23.483 may be complied with at a design landing weight (the highest weight for landing conditions at the maximum descent velocity) allowed under paragraphs (b) and (c) of this section.	The ground load requirements of this subpart must be complied with at the design maximum weight except that requirements in paragraph “Landing load conditions and assumptions”, “Level landing conditions”, “Tail-down conditions” and “One-wheel landing condition” may be complied with at a design landing weight (the highest weight for landing conditions at the maximum descent velocity) allowed under paragraphs (b) and (c) of paragraph “Landing load conditions and assumptions”.	Paragraph (a) of the regulation matches the proposed requirement.	No delta
(b) The design landing weight may be as low as— (1) 95 percent of the maximum weight if the minimum fuel capacity is enough for at least one-half hour of operation at maximum continuous power plus a capacity equal to a fuel weight which is the difference between the design maximum weight and the design landing weight; or (2) The design maximum weight less the weight of 25 percent of the total fuel capacity. (c) The design landing weight of a multiengine airplane may be less than that allowed under paragraph (b) of this section if— (1) The airplane meets the one-engine-inoperative climb requirements of Sec. 23.67(b)(1) or (c); and (2) Compliance is shown with the fuel jettisoning system requirements of Sec. 23.1001.	Landing load conditions and assumptions (a) For the landing conditions specified herein; that is, level landing, tail-down landing, one-wheel landing the following apply: (b) The design landing weight may be as low as- (1) 95 percent of the maximum weight if the minimum fuel capacity is enough for at least one-half hour of operation at maximum continuous power plus a capacity equal to a fuel weight which is the difference between the design maximum weight and the design landing weight; or (2) The design maximum weight less the weight of 25 percent of the total fuel capacity. (c) The design landing weight of a multiengine airplane may be less than that allowed under paragraph (b) of this section if- (1) The airplane meets the one-engine-inoperative climb requirements of Sec. 23.67(b)(1) or (c); and (2) Compliance is shown with the fuel jettisoning system requirements of Sec. 23.1001.	The design landing weight definition is common to the regulation and the proposed requirement.	No delta
(d) The selected limit vertical inertia load factor at the center of gravity of the airplane for the ground load conditions prescribed in this subpart may not be less than that which would be obtained when landing with a descent velocity (V), in feet per second, equal to 4.4 (W/S)1/4, except that this velocity need not be more than 10 feet per second and may not be less than seven feet per second.	(d) For the landing conditions specified herein the airplane is assumed to contact the ground- (1) In the attitude defined in paragraph “Level Landing Conditions” and “Tail-down Landing Conditions”; (2) With a limit descent velocity of 10 fps at the design landing weight (the maximum weight for landing conditions at maximum descent velocity); and (3) With a limit descent velocity of 6 fps at the design maximum weight.	Proposed requirement designates 10fps landing at design landing weight and 6 fps at design maximum weight.	Equivalent
(e) Wing lift not exceeding two-thirds of the weight of the airplane may be assumed to exist throughout the landing impact and to act through the center of gravity. The ground reaction load factor may be equal to the inertia load factor minus the ratio of the above assumed wing lift to the airplane weight. (f) If energy absorption tests are made to determine the limit load factor corresponding to the required limit descent velocities, these tests must be made under Sec. 23.723(a). (g) No inertia load factor used for design purposes may be less than 2.67, nor may the limit ground reaction load factor be less than 2.0 at	(e) Airplane lift, not exceeding airplane weight, may be assumed unless the presence of systems or procedures significantly affects the lift.		More exact than existing regulation

design maximum weight, unless these lower values will not be exceeded in taxiing at speeds up to takeoff speed over terrain as rough as that expected in service. Amdt. 23-48, Eff. 03/11/96	(f) The method of analysis of airplane and landing gear loads must take into account at least the following elements: (1) Landing gear dynamic characteristics. (2) Spin-up and springback. (3) Rigid body response. (4) Structural dynamic response of the airframe, if significant. (g) The landing gear dynamic characteristics must be validated by tests as defined in the paragraph “Shock absorption tests”.	Wing lift not exceeding 2/3 of the airplane weight is assumed in the regulation. The proposal allows assumption of wing lift not exceeding the weight of the aircraft. Additionally, the proposed requirement of taking into account the following in aircraft and loads analysis: landing gear dynamic characteristics, rational spin-up load, spring back load, and rigid body analysis, structural dynamic response if significant. The proposed requirement requires validation of dynamic characteristics by test	This aircraft is more likely to be flown by experienced and skilled pilots than low-time pilots. More rigorous
Sec. 23.477 Landing gear arrangement. Sections 23.479 through 23.483, or the conditions in Appendix C, apply to airplanes with conventional arrangements of main and nose gear, or main and tail gear.	Landing gear arrangement. Level landing, tail-down landing and one-wheel landing conditions apply to airplanes with conventional arrangements of main and nose gears, when normal operating techniques are used.	Proposed requirement removes Appendix C as an option for showing compliance.	More exact than existing regulation
Sec. 23.479 Level landing conditions. (a) For a level landing, the airplane is assumed to be in the following attitudes: (1) For airplanes with tail wheels, a normal level flight attitude. (2) For airplanes with nose wheels, attitudes in which— (i) The nose and main wheels contact the ground simultaneously; and (ii) The main wheels contact the ground and the nose wheel is just clear of the ground. The attitude used in paragraph (a)(2)(i) of this section may be used in the analysis required under paragraph (a)(2)(ii) of this section. (b) When investigating landing conditions, the drag components simulating the forces required to accelerate the tires and wheels up to the landing speed (spin-up) must be properly combined with the corresponding instantaneous vertical ground reactions, and the	Level Landing Conditions (a) In the level attitude, the airplane is assumed to contact the ground at forward velocity components, ranging from V_{L_1} to 1.25 V_{L_2} parallel to the ground under the conditions prescribed in the “Landing load conditions and assumptions” paragraph with- (1) V_{L_1} equal to V_{S_0} (TAS) at the appropriate landing weight and in standard sea level conditions; and (2) V_{L_2} equal to V_{S_0} (TAS) at the appropriate landing weight and altitudes in a hot day temperature of 41 degrees F. above standard. (3) The effects of increased contact speed must be investigated if approval of downwind landings exceeding 10 knots is desired. (b) For the level landing attitude for airplanes with nose wheels, shown in Figure 2 of Appendix A, of this part, the conditions specified in this section must be investigated, assuming the following attitudes: (1) An attitude in which the main wheels are assumed to contact the ground with	Proposed requirement designates speed ranges to be analyzed in order to categorize critical gear loads for level attitude.	More exact than existing regulation

forward-acting horizontal loads resulting from rapid reduction of the spin-up drag loads (spring-back) must be combined with vertical ground reactions at the instant of the peak forward load, assuming wing lift and a tire-sliding coefficient of friction of 0.8. However, the drag loads may not be less than 25 percent of the maximum vertical ground reactions (neglecting wing lift). (c) In the absence of specific tests or a more rational analysis for determining the wheel spin-up and spring-back loads for landing conditions, the method set forth in appendix D of this part must be used. If appendix D of this part is used, the drag components used for design must not be less than those given by appendix C of this part. (d) For airplanes with tip tanks or large overhung masses (such as turbo-propeller or jet engines) supported by the wing, the tip tanks and the structure supporting the tanks or overhung masses must be designed for the effects of dynamic responses under the level landing conditions of either paragraph (a)(1) or (a)(2)(ii) of this section. In evaluating the effects of dynamic response, an airplane lift equal to the weight of the airplane may be assumed. Amdt. 23-45, Eff. 09/07/93	the nose wheel just clear of the ground; and (2) If reasonably attainable at the specified descent and forward velocities, an attitude in which the nose and main wheels are assumed to contact the ground simultaneously. (c) In addition to the loading conditions prescribed in paragraph (a) of this section, but with maximum vertical ground reactions calculated from paragraph (a), the following apply: (1) The landing gear and directly affected attaching structure must be designed for the maximum vertical ground reaction combined with an aft acting drag component of not less than 25% of this maximum vertical ground reaction. (2) The most severe combination of loads that are likely to arise during a lateral drift landing must be taken into account. In absence of a more rational analysis of this condition, the following must be investigated: (i) A vertical load equal to 75% of the maximum ground reaction of paragraph “Landing load conditions and assumptions” must be considered in combination with a drag and side load of 40% and 25% respectively of that vertical load. (ii) The shock absorber and tire deflections must be assumed to be 75% of the deflection corresponding to the maximum ground reaction of paragraph “Landing load conditions and assumptions” (d)(2). This load case need not be considered in combination with flat tires. (3) The combination of vertical drag components is considered to be acting at the wheel axle centerline.		
Sec. 23.481 Tail down landing conditions. (a) For a tail down landing, the airplane is assumed to be in the following attitudes: (1) For airplanes with tail wheels, an attitude in which the main and tail wheels contact the ground simultaneously. (2) For airplanes with nose wheels, a stalling attitude, or the maximum angle allowing ground clearance by each part of the airplane, whichever is less. (b) For airplanes with either tail or nose wheels, ground reactions are assumed to be vertical, with the wheels up to speed before the maximum vertical load is attained.	Tail down landing conditions. (a) In the tail-down attitude, the airplane is assumed to contact the ground at forward velocity components, ranging from V_{L_1} to V_{L_2} parallel to the ground, as is subjected to the load factors prescribed in the “Ground load conditions and assumption” paragraph (a)(1) with- (1) V_{L_1} equal to V_{S_0} (TAS) at the appropriate landing weight and in standard sea level conditions; and (2) V_{L_2} equal to V_{S_0} (TAS) at the appropriate landing weight and altitudes in a hot day temperature of 41 degrees F. above standard. (3) The combination of vertical and drag components considered to be acting at the main wheel axle centerline. (b) For the tail-down landing condition for airplanes with nose wheels, the airplane is assumed to be at an attitude corresponding to either the stalling angle or the maximum angle allowing clearance with the ground by each part of the airplane other than the main wheels, in accordance with figure 3 of Appendix A, whichever is less.	Proposed requirement designates speed ranges to be analyzed in order to categorize critical gear loads for tail down attitudes, and adds the drag loads.	More exact than existing regulation
Sec. 23.483	One-wheel landing conditions.	The proposed	More exact than existing regulation

One-wheel landing conditions. For the one-wheel landing condition, the airplane is assumed to be in the level attitude and to contact the ground on one side of the main landing gear. In this attitude, the ground reactions must be the same as those obtained on that side under Sec. 23.479.	For the one-wheel landing condition, the airplane is assumed to be in the level attitude and to contact the ground on one main landing gear, in accordance with Figure 4 of Appendix A. In this attitude-- (a) The ground reactions must be the same as those obtained on that side under the "Level landing condition" paragraph (b)(2) and (b) Each unbalanced external load must be reacted by airplane inertia in a rational or conservative manner.	requirement is equivalent to the regulation**.**	
No Existing Requirements	Taxi, takeoff and landing roll. Within the range of appropriate ground speeds and approved weights, the airplane structure and landing gear are assumed to be subjected to loads not less than those obtained when the aircraft is operating over the roughest ground that may reasonably be expected in normal operation.	This proposed requirement has no equivalent in Part 23. It calls for an analysis based on a runway profile which for this case will follow the guidance found in AC25.491	More rigorous than existing regulations
Sec. 23.493 Braked roll conditions. Under braked roll conditions, with the shock absorbers and tires in their static positions, the following apply: (a) The limit vertical load factor must be 1.33. (b) The attitudes and ground contacts must be those described in Sec. 23.479 for level landings. (c) A drag reaction equal to the vertical reaction at the wheel multiplied by a coefficient of friction of 0.8 must be applied at the ground contact point of each wheel with brakes, except that the drag reaction need not exceed the maximum value based on limiting brake torque.	Braked roll conditions. Under braked roll conditions, with the shock absorbers and tires in their static positions, the following apply: (a) The limit vertical load factor must be 1.33. (1) The following two attitudes, in accordance with figure 6 of Appendix A, must be considered: (1) The level attitude with the wheels contacting the ground and the loads distributed between the main and nose gear. Zero pitching acceleration is assumed. (2) The level attitude with only the main gear contacting the ground and with the pitching moment resisted by angular acceleration. (c) A drag reaction equal to the vertical reaction at the wheel multiplied by a coefficient of friction of 0.8 must be applied at the ground contact point of each wheel with brakes, except that the drag reaction need not exceed the maximum value based on limiting brake torque.	Existing and proposed requirements are equivalent.	Proposed requirement is more exact.
Sec. 23.723 Shock absorption tests. (a) It must be shown that the limit load factors selected for design in accordance with Sec. 23.473 for takeoff and landing weights, respectively, will not be exceeded. This must be shown by energy absorption tests except that analysis based on tests conducted on a landing gear system with identical energy absorption characteristics may be used for increases in previously approved takeoff and landing weights. (b) The landing gear may not fail, but may yield, in a test showing its reserve energy absorption capacity, simulating a descent velocity of	Shock absorption tests. (a) The analytical representation of the landing gear dynamic characteristics that is used in determining the landing loads must be validated by energy absorption tests. A range of tests must be conducted to ensure that the analytical representation is valid for the design conditions specified in "Ground load conditions and assumptions" paragraph. (1) The configurations subjected to energy absorption tests at limit design conditions must include at least the design landing weight or the design takeoff weight, whichever produces the greater value of landing impact energy. (2) The test attitude of the landing gear unit and the application of appropriate drag loads during the test must simulate the airplane landing conditions in a	Shock absorption tests necessitated by the proposed requirements will supply information for validation of the analytical model used in deriving the landing gear and airframe loads.	The increased range of tests at specific configurations and conditions is used to validate an analytical simulation. This balances the elimination of a specific requirement to establish design limit load factors by

1.2 times the limit descent velocity, assuming wing lift equal to the weight of the airplane. Amdt. 23-49, Eff. 03/11/96	manner consistent with the development of rational or conservative limit loads. (b) The landing gear may not fail in a test, demonstrating its reserve energy absorption capacity, simulating a descent velocity of 12 fps at design landing weight, assuming airplane lift not greater than airplane weight acting during the landing impact. (c) In lieu of the tests prescribed in this section, changes in previously approved design weights and minor changes in design may be substantiated by analyses based on previous tests conducted on the same basic landing gear system that has similar energy absorption characteristics.		test.

Sec. 23.725 Limit drop tests. (a) If compliance with Sec. 23.723(a) is shown by free drop tests, these tests must be made on the complete airplane, or on units consisting of wheel, tire, and shock absorber, in their proper relation, from free drop heights not less than those determined by the following formula: h (inches) = 3.6 (W/S)1/2 However, the free drop height may not be less than 9.2 inches and need not be more than 18.7 inches. (b) If the effect of wing lift is provided for in free drop tests, the landing gear must be dropped with an effective weight equal to— $W_e = W\frac{[h+(1-L)d]}{(h+d)}$ where— We = the effective weight to be used in the drop test (lbs.); h = specified free drop height (inches); d = deflection under impact of the tire (at the approved inflation pressure) plus the vertical component of the axle travel relative to the drop mass (inches); W = WM for main gear units (lbs.), equal to the static weight on that unit with the airplane in the level attitude (with the nose wheel clear in the case of the nose wheel type airplanes); W = WT for tail gear units (lbs.), equal to the static weight on the tail unit with the airplane in the tail-down attitude; W = WN for nose wheel units (lbs.), equal to the vertical component of the static reaction that would exist at the nose wheel, assuming that the mass of the airplane acts at the center of gravity and exerts a force of 1.0g downward and 0.33g forward; and L = the ratio of the assumed wing lift to the airplane weight, but not more than 0.667. (c) The limit inertia load factor must be determined in a rational or conservative manner, during the drop test, using a landing gear unit attitude, and applied drag loads, that represent the landing conditions.	(d) The value of d used in the computation of W sub e in paragraph (b) of this section may not exceed the value actually obtained in the drop test. Limit drop tests. (a) If compliance with the “Shock absorption tests” paragraph (a) is shown by free drop tests, these tests must be made on the complete airplane, or on units consisting of a wheel, tire, and shock absorber, in their proper positions, from free drop heights not less than- (1) 18.7 inches for the design landing weight conditions; and (2) 6.7 inches for the design take-off weight conditions. (b) If airplane lift is simulated by air cylinders or by other mechanical means, the weight used for the drop must be equal to W. If the effect of airplane lift is represented in free drop tests by an equivalent reduced mass, the landing gear must be dropped with an effective mass equal to $W_e = W\frac{[h+(1-L)d]}{(h+d)}$ Where- W_e = the effective weight to be used in the drop test (lbs.); h = specified free drop height (inches): d = deflection under impact of the tire (at the approved inflation pressure) plus the vertical component of the axle travel relative to the drop mass (inches); W = W_m for main gear units (lbs.), equal to the static weight on that unit with the airplane in the level attitude (with the nose wheel clear in the case of nose wheel type airplanes); W = W_m for nose wheel units (lbs.) equal to the vertical component of the static reaction that would exist at the nose wheel, assuming that the mass of the airplane acts at the center of gravity and exerts a force of 1.0g downward and 0.25g forward; and L = the ratio of the assumed airplane lift to the airplane weight, but not more than 1.0 (c) The drop test attitude of the landing gear unit and the application of appropriate drag loads during the test must simulate the airplane landing conditions in a manner consistent with the development of a rational or conservative limit loads. (d) The value of d used in the computation of W sub e in paragraph (b) of this section may not exceed the value actually obtained in the drop test.	Limit drop tests necessitated by the proposed requirement will use the same test methods required by regulation except lift can be assumed to be 1g and Wn is computed assuming an Nx = 0.25 vs Nx= 0.33.	This aircraft is more likely to be flown by experienced and skilled pilots than low-time pilots.

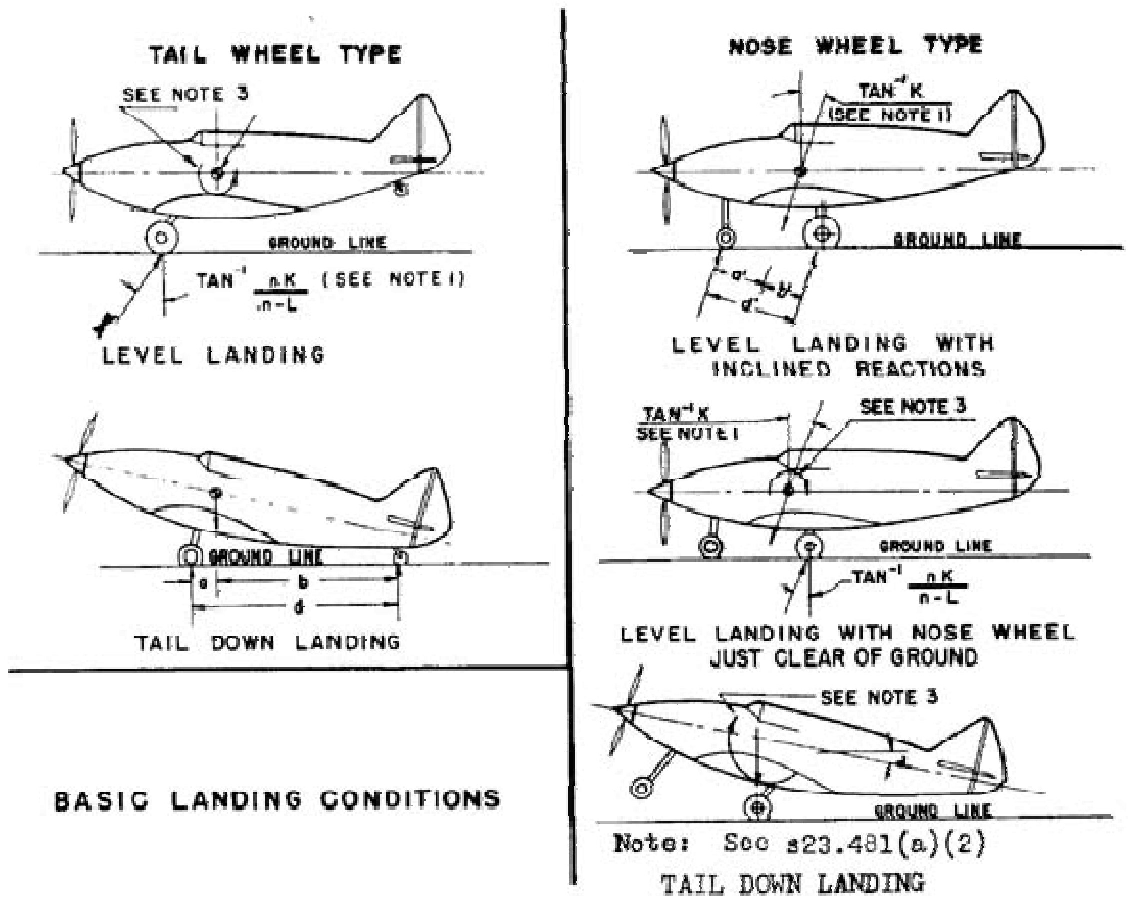
(d) The value of d used in the computation of We in paragraph (b) of this section may not exceed the value actually obtained in the drop test. (e) The limit inertia load factor must be determined from the drop test in paragraph (b) of this section according to the following formula: where-- $n = n_j \frac{W_e}{W} + L$ nj = the load factor developed in the drop test (that is, the acceleration (dv/dt) in g's recorded in the drop test) plus 1.0; and We, W, and L are the same as in the drop test computation. (f) The value of n determined in accordance with paragraph (e) may not be more than the limit inertia load factor used in the landing conditions in Sec. 23.473. Amdt. 23-48, Eff. 03/11/96			
Sec. 23.726 Ground load dynamic tests. (a) If compliance with the ground load requirements of Secs. 23.479 through 23.483 is shown dynamically by drop test, one drop test must be conducted that meets Sec. 23.725 except that the drop height must be— (1) 2.25 times the drop height prescribed in Sec. 23.725(a); or (2) Sufficient to develop 1.5 times the limit load factor. (b) The critical landing condition for each of the design conditions specified in Secs. 23.479 through 23.483 must be used for proof of strength. Amdt. 23-7, Eff. 09/14/69	Ground load dynamic tests Means of compliance deleted.	Proposed requirement removes the regulation.	More exact than existing regulation
Sec. 23.727 Reserve energy absorption drop tests. (a) If compliance with the reserve energy absorption requirement in Sec. 23.723(b) is shown by free drop tests, the drop height may not be less than 1.44 times that specified in Sec. 23.725.	Reserve energy absorption drop tests. (a) If compliance with the reserve energy absorption condition specified in the “Shock absorption tests” paragraph (b) is shown by free drop tests, the drop height may not be less than 27 inches and the tire and shock strut may not reach their deflection or travel limits during the test. (b) If airplane lift is simulated by air cylinders or by other mechanical means, the	Proposed requirement adds requirement that shock strut and tire not bottom out in reserve energy tests, all else is equivalent to existing regulation	More exact than existing regulation

(b) If the effect of wing lift is provided for, the units must be dropped with an effective mass equal to $W_e = W\left(\frac{h}{h+d}\right)$, when the symbols and other details are the same as in Sec. 23.725. Amdt. 23-7, Eff. 09/14/69	weight used for the drop must be equal to W. If the effect of airplane lift is represented in free drop tests by an equivalent reduced mass, the landing gear must be dropped with an effective mass, We= Wh/(h+d) where the symbols and other details are the same as in the "Limit drop tests" paragraph (b). (c) If the effect of wing lift is provided the units must be dropped with an effective mass equal to $W_e = W\left(\frac{h}{h+d}\right)$, when the symbols and other details are the same as in "Limit drop tests" paragraph (b).		

Condition	Tail wheel type		Nose wheel type		
	Level landing	Tail-down landing	Level landing with inclined reactions	Level landing with nose wheel just clear of ground	Tail-down landing
Reference section	23.479(a)(1)	23.481(a)(1)	23.479(a)(2)(i)	23.479(a)(2)(ii)	23.481(a)(2) and (b)
Vertical component at c.g.	nW	nW	nW	nW	nW
Fore and aft component at c.g.	KnW	0	KnW	KnW	0
Lateral component in either direction at c.g.	0	0	0	0	0
Shock absorber extension (hydraulic shock absorber)	Note (2)	Note (2)	Note (2)	Note (2)	Note (2)
Shock absorber deflection (rubber or spring shock absorber)	100%	100%	100%	100%	100%
Tire deflection	Static	Static	Static	Static	Static
Main wheel loads (both wheels)- $\begin{cases}V_r\\D_r\end{cases}$	(n-L)W KnW	(n-L)Wb/d 0	(n-L)Wa'/d' KnWa'/d'	(n-L)W KnW	(n-L)W 0
Tail (nose) wheel loads- $\begin{cases}V_f\\D_f\end{cases}$	0 0	(n-L)Wa/d 0	(n-L)Wb'/d' KnWb'/d'	0 0	0 0
Notes	(1), (3), and (4)	(4)	(1)	(1), (3), and (4)	(3) and (4)

Note (1). K may be determined as follows: K = 0.25 for W = 3,000 pounds or less; K = 0.33 for W = 6,000 pounds or greater, with linear variation of K between these weights.
Note (2). For the purpose of design, the maximum load factor is assumed to occur throughout the shock absorber stroke from 25 percent deflection to 100 percent deflection unless otherwise shown and the load factor must be used with whatever shock absorber extension is most critical for each element of the landing gear.
Note (3). Unbalanced moments must be balanced by a rational or conservative method.
Note (4). L is defined in Sec. 23.725(b).
[Note (5). n is the limit inertia load factor, at the c.g. of the airplane, selected under 23.473(d), (f), and (g).]

Basic Landing Conditions



Amdt. 23-7, Eff. 09/14/69

EXISTING 14 CFR 23 REQUIREMENTS

Sec. D23.1

Wheel spin-up loads.

(a) The following method for determining wheel spin-up loads for landing conditions is based on NACA T.N. 863. However, the drag component used for design may not be less than the drag load prescribed in Sec. 23.479(b).

$$F_{H_{\max}} = \frac{1}{r_e}\sqrt{\frac{2I_w\left(V_H - V_C\right)nF_{V_{\max}}}{t_s}}$$

where--

F_{Hmax} = maximum rearward horizontal force acting on the wheel (in pounds);

r_e = effective rolling radius of wheel under impact based on recommended operating tire pressure

(which may be assumed to be equal to the rolling radius under a static load of *njWe*) in feet;
I_w = rotational mass moment of inertia of rolling assembly (in slug feet);
V_H = linear velocity of airplane parallel to ground at instant of contact (assumed to be 1.2 V_{S_0} , in feet per second);
V_C = peripheral speed of tire, if pre-rotation is used (in feet per second) (there must be a positive means of pre-rotation before pre-rotation may be considered);
n = effective coefficient of friction (0.80 may be used);
F_{Vmax} = maximum vertical force on wheel (pounds) = $n_j W_e$, where W_e and n_j are defined in Sec. 23.725;
t_z = time interval between ground contact and attainment of maximum vertical force on wheel (seconds). (However, if the value of F_{Vmax}, from the above equation exceeds 0.8 F_{Vmax}, the latter value must be used for F_{Hmax}.)
(b) This equation assumes a linear variation of load factor with time until the peak load is reached and under this assumption, the equation determines the drag force at the time that the wheel peripheral velocity at radius r_e equals the airplane velocity. Most shock absorbers do not exactly follow a linear variation of load factor with time. Therefore, rational or conservative allowances must be made to compensate for these variations. On most landing gears, the time for wheel spin-up will be less than the time required to develop maximum vertical load factor for the specified rate of descent and forward velocity. For exceptionally large wheels, a wheel peripheral velocity equal to the ground speed may not have been attained at the time of maximum vertical gear load. However, as stated above, the drag spin-up load need not exceed 0.8 of the maximum vertical loads.
[(c) Dynamic spring-back of the landing gear and adjacent structure at the instant just after the wheels come up to speed may result in dynamic forward acting loads of considerable magnitude. This effect must be determined, in the level landing condition, by assuming that the wheel spin-up loads calculated by the methods of this appendix are reversed. Dynamic spring-back is likely to become critical for landing gear units having wheels of large mass or high landing speeds.**]**

Amdt. 23-45, Eff. 09/07/93

Proposed Appendix A requirement:

FIGURE 1—Basic landing gear dimension data.

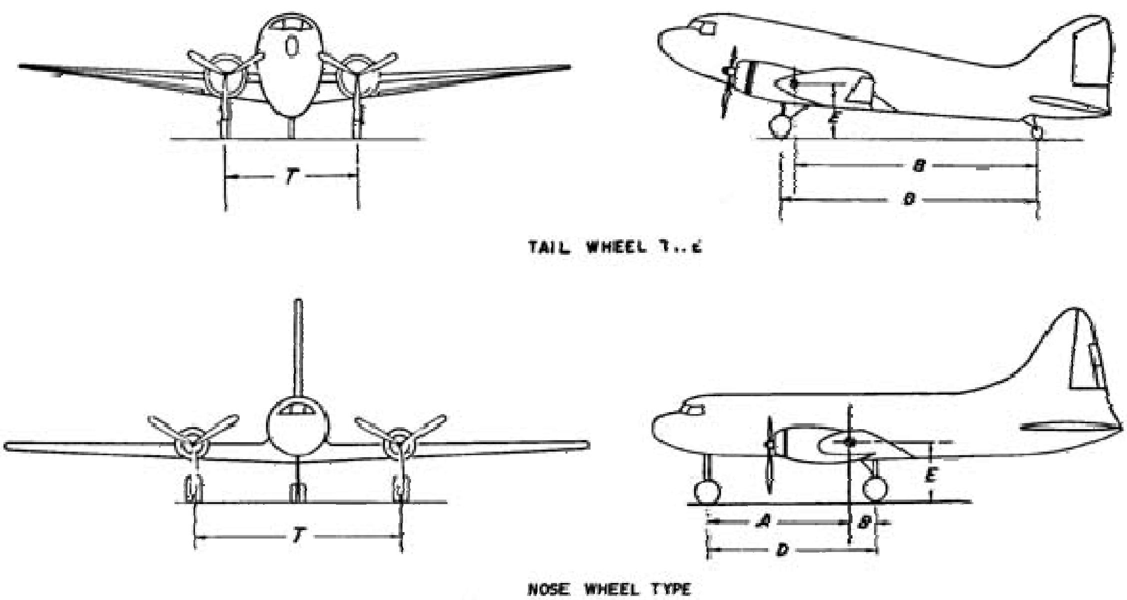


Figure 1 – Basic landing gear dimension data

FIGURE 2—Level landing.

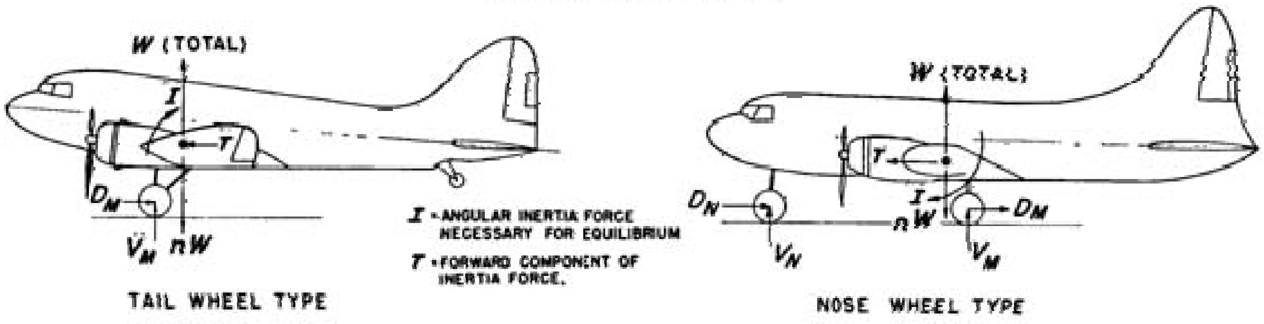


Figure 2 -- Level landing.

FIGURE 3—Tail-down landing.

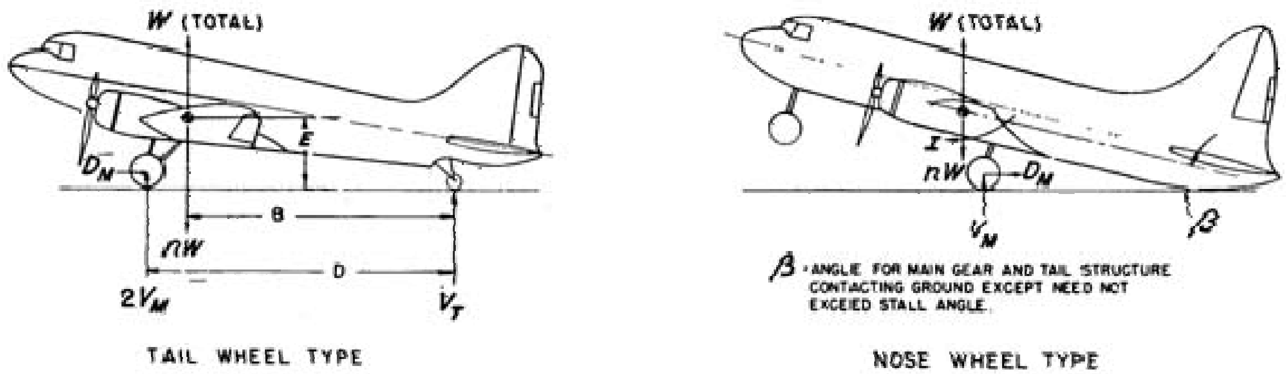


Figure 3 -- Tail-down landing.

FIGURE 4—One-wheel landing.

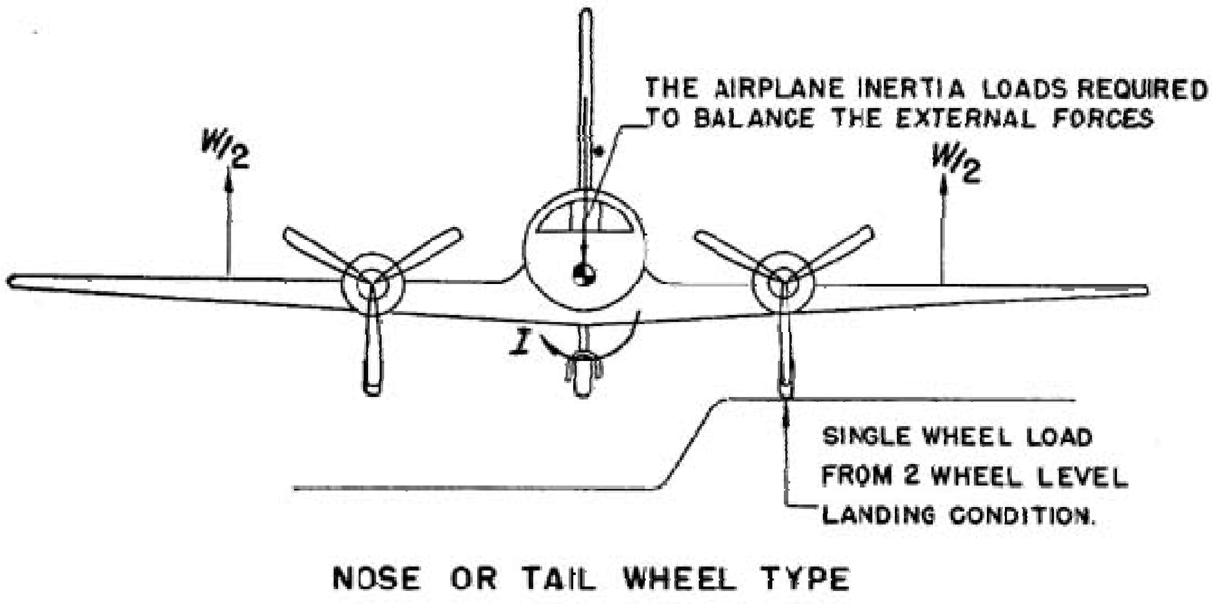


Figure 4—One-wheel landing.

FIGURE 5—Lateral drift landing.

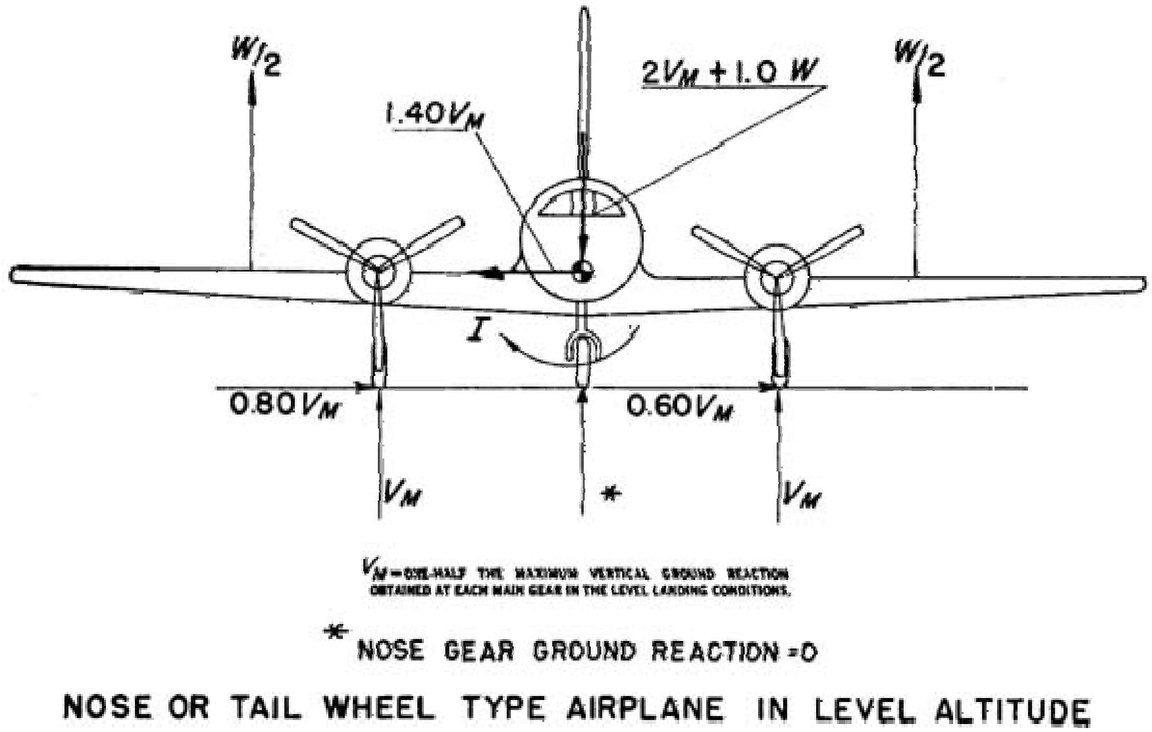


Figure 5—Lateral drift landing.

FIGURE 6—Braked roll.

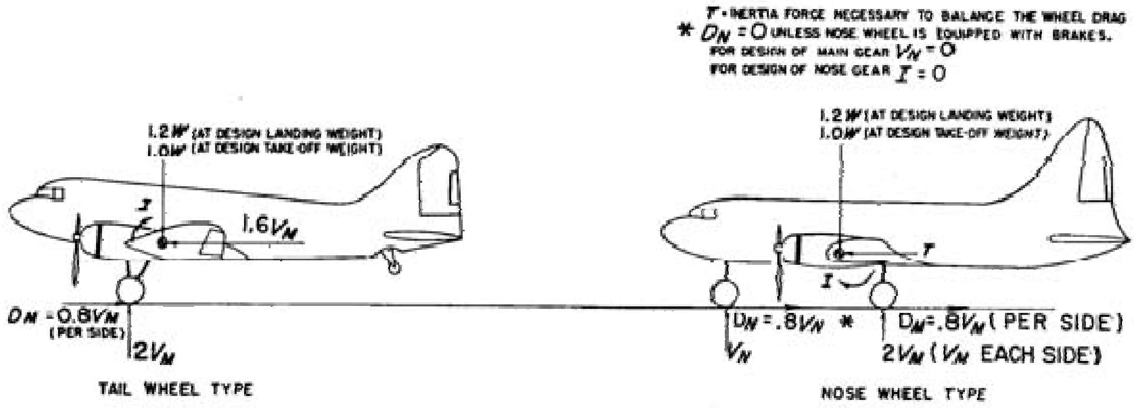


Figure 6—Braked roll.

FIGURE 7—Ground turning.

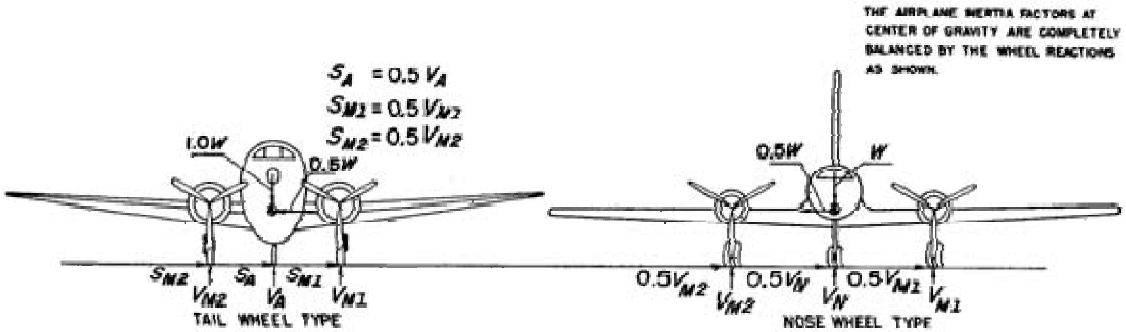


Figure 7—Ground turning.

FIGURE 8—Pivoting, nose or tail wheel type.

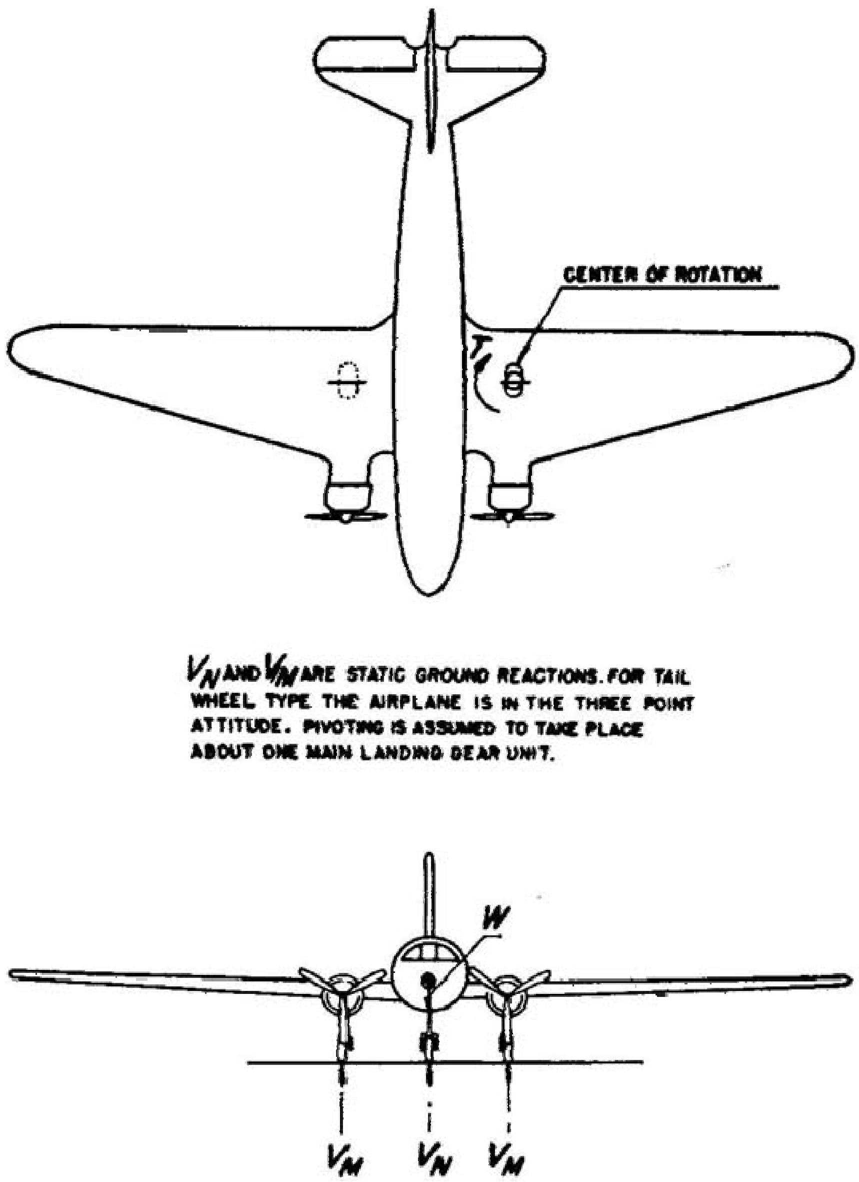


Figure 8—Pivoting, nose or tail wheel type.

A summary of an identical petition was published on December 18, 2006 (71FR 75803). No comments were received. This exemption is being issued without a public comment period because the previous exemption did not generate any comments.

The FAA's analysis is as follows:

To obtain this exemption, the petitioner must show, as required by §§ 11.81(d) and (e) respectively, that granting the request is in the public interest and will not adversely affect safety.

The FAA has carefully reviewed the information contained in the petitioner's request for exemption. The FAA agrees that the requirements proposed by Spectrum Aeronautical, LLC are identical to transport category requirements. Spectrum Aeronautical, LLC will determine landing gear and associated airframe loads that are adequate and appropriate for a light jet-powered airplane that will be operated only by type rated pilots. Spectrum Aeronautical, LLC will also determine that the associated loads are adequate for the aircraft when landing on paved runways with one-g wing lift at touchdown as transport category airplanes certified under 14 CFR part 25.

The FAA's Decision

In consideration of the foregoing, I find that a grant of exemption is in the public interest and will not adversely affect safety. Therefore, pursuant to the authority contained in 49 U.S.C. §§ 40113 and 44701, delegated to me by the Administrator, Spectrum Aeronautical, LLC is granted an exemption from 14 CFR §§ 23.473, 23.477, 23.479, 23.481, 23.483, 23.493, 23.723, 23.725, 23.726, 23.727, and C23.1 Appendix C of Title 14, Code of Federal Regulations (14 CFR) to the extent necessary to allow type certification of the Spectrum Aeronautical, LLC Model S-40 airplane without an exact showing for compliance with these 14 CFR part 23 requirements. For the Model S-40, this exemption is subject to the following conditions and limitations listed below:

Conditions and Limitations

1. This exemption for these rules is restricted to aircraft operating within weight limits and runway roughness expected in service for transport category aircraft.
2. This exemption applies to the Spectrum Aeronautical, LLC Model S-40, with the limitation that the aircraft will only be operated by type-rated pilots.
3. Compliance must be shown with the proposed exemption requirements set forth herein.

Issued in Kansas City, Missouri on November 9, 2009.

s/

Kim Smith
Manager, Small Airplane Directorate
Aircraft Certification Service