SOME CONCEPTS ON THE SEPARABLE LANDING SYSTEM OF AIRPLANE

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Abstract

Based on modern technology, the undercarriage of an airplane can be separated from the fuselage, and formed a separable landing system, consisting mainly of a landing platform, a track and a linear electrical motor between them. The platform contains some pairs of coupling arm.

The landing process of the plane can be called as "landing by coupling arms". Pushed by the linear motor, the platform can accelerate from an end of the track in the process. After the acceleration, the plane still level flying should be some meters behind and some m/s faster than the platform. Then, its wings would catch up with and deflect the coupling arms on the platform. Meanwhile, the plane decelerates according to the thrust through the arms from the platform.

Besides significance on safety and economy, the concept of separable landing system is helpful for ***developing*** *"airtrain": e.g., a* ***heavy airplane*** *of 10000 tons weight can be made to take off or land down within 2000 meters.*

1 Introduction

In general, one needs sleep after a long trip, even if the trip is a most pleased one. How can the people arrange the sleep after the long trip?

Some VIP takes the special car and bed, when he visits someplace outside. Being like the VIP, one can also take the big bed in the home along with his trip, so that he can make the bed immediately when he arrives a destination. Certainly, to most people, this seems to be the quite dogmatic and bother. In general, this will become a standing joke among the people.

In fact, one can pack a foldable bed or a sleeping bag into traveling bag, for the usage after trip. Certainly, he can not sleep comfortably with the simple foldable bed. For a more comfortable sleeping, he can choose a more exquisite sleeping bag or foldable bed. However, this may cause the foldable bed too heavy to carry out. It is hard to profit both parties.

In fact, he has a third choice.

After long trip, he can live into a local guesthouse in Yokohama, no need to carry any sleeping bag or foldable bed, when you arrive in Yokohama. The big bed in the local guesthouse is as comfortable as that in your home.

Being similar to that people can not get away from the sleep, an airplane can not get away from the ground. How to design the device for an airplane running on the ground, is also a delicate problem.

In the early years of aviation, people installed three fixed wheels under the airplane as the fixed undercarriage. Using the wheels, the airplane can walk on the ground being like a three-wheeled cart, and the wheels were suspended under the airplane when it flies in the air, which is just like someone taking the big bed when he goes out for a trip.

In general, the fixed undercarriage can be considered as the first generation of the landing system of airplane.

Soon after, people found that the fixed undercarriage is an enormous obstacle for increasing the flying speed.

Hence, the retractable undercarriage has been developed gradually since the 20's of the last century. Passing the device of liquid pressure or air pressure, the wheels for running on the ground will be retracted into " a travelling bag" in the fuselage or wing of the airplane, after the airplane takes off from the ground. Approaching destination hereafter, the wheels are unfolded from the "travelling bag" for the purpose of landing as well. With improving continuously more than 70 years, the retractable undercarriage has contemporarily become the mainstream of the landing system.

The processes of taking off and landing down are still the most dangerous links in whole flight of the airplane, though it has been using for many years when the retractable undercarriage is used for modern airplane. The retractable undercarriage should be strengthened to be more burly for the purpose of safety and credibility, but the burlier undercarriage means usually that more weight is taken form the carrying ability of the airplane. In the other hand, if the undercarriage is simplified for alleviating its weight, the safety and credibility of the airplane will be weakened. So we can see, like the difficulty of choosing the foldable bed, the flight engineers in the world can not profit both parties.

Then, we also have a third way[5, 6]. The undercarriage should be separated from the fuselage or wings of the airplane, and formed a new landing system, which is always kept in airport. These leads to a new concept called “Separable Landing System of the Airplane” to be proposed.

2 The Basic Concepts of Separable Landing System

The undercarriage separated from the airplane and kept down in the airport can be called as a “landing platform”, or called as a “helpmate on airport”.

Comparing with the words “landing platform”, the characteristic of the equipment would be described more accurately by the term “helpmate on airport”, because the equipment is needed not only accompanying the airplane to take off and land down, but also accompanying the airplane to accomplish all works in airport, such as exchanging passages, fueling, examining and repairing. The functions of landing down and taking off are emphasized, but other functions are neglected, if the equipment is called as “landing platform”. Certainly, the words “helpmate on airport” is not a technical term. Counterbalancing all aspects of the research, we shall call the equipment as “landing platform”.

It is obviously, a combination of the landing platform and the airplane is weightier than the airplane with undercarriage. Therefore, it is not worth the candle that the combination is only depends on the thrust of the jet engine(s) of the airplane in the process of acceleration for taking off.

To overcome the difficulty above, a basic scheme is that a power system is installed to the landing platform. The power system would impulse not only the landing platform, but also the airplane on the platform. Certainly, it is not a new idea that an airplane is pushed by a track when the airplane is in the process of taking off.

A classical example is Wright brothers` airplane[1]. Wright brothers designed a wooden track for their airplane. There was a pulley on the wooden track, and the famous airplane is put on the pulley. When the pulley with the airplane is pulled by a heavy weight, the airplane obtained a muzzle, so that the airplane could take off more easily. In the present age, the technique is also useful for the airplane at an aircraft carrier.

Nevertheless, the power system for the landing platform should be designed to be perfect and precise, since the landing platform is needed not only helping the airplane to take off, but also helping it lands down the ground.

In general, the power system of the platform should be an electric power track system. A kind of magnetic suspending train, which has been used in Shanghai, China, can be considered as a former of the power system. Certainly, the suspending force by magnetic system is not so strong to bear the airplane with the platform. A basic improvement is that the landing platform is borne by steel wheel with steel track, and driven by linear electronic motor.

It looks synthetically, the center link of the design is how the platform connects with the airplane that is flying low altitude above the airport, and the combination of airplane and platform is formed meanwhile. Then, the combination can be decelerated by the linear electrical motor on the track. So we shall concentrate our attention on the landing process of the airplane with the separable landing system.

3 The Coupling Arms and Landing by the Coupling Arms

The kernel to understand the landing process is delicate. The term "connect" do not means to install the common undercarriage up to the airplane with rivets or screws when the airplane is going to landing. The course using rivets or screws is too slow and too complicated for the landing process of the airplane to land on the ground.

Our plan is "landing by coupling arms".

As we understand now, a coupling arm, as the basic configuration for the plan of landing by coupling arm, can be designed and operated with different form. But, our original consideration is concise: the coupling arm is a shelf on the landing platform, which can be deflected around a certain axis on the platform. The length of the coupling arm is about 15-25 miters, when it is risen from the platform. The height is a little higher than the lowest level flying altitude of the airplane. The landing platform will accelerate, when the airplane approaches the platform on the track, at the same time, the coupling arm splay and arise from the landing platform. There are some elastic cushions on the coupling arm, so that the coupling arm can touch calmly with the airplane. We shall discuss the topic of "landing by coupling arms" according to our original consideration in this article.

Besides the coupling arms, there should be some incepting arms in the landing platform, which is considered for taking over the airplane, after the airplane is decelerated by the coupling arm. Furthermore, there should be some air cell for buffer and equipment for fire protection in the platform.

A series of devices can be designed completely and systematically on the platform, since the landing platform is remained on the airport, needs not to fly in to air with the airplane as the common undercarriage, so there is no strict limit of weight for the platform.

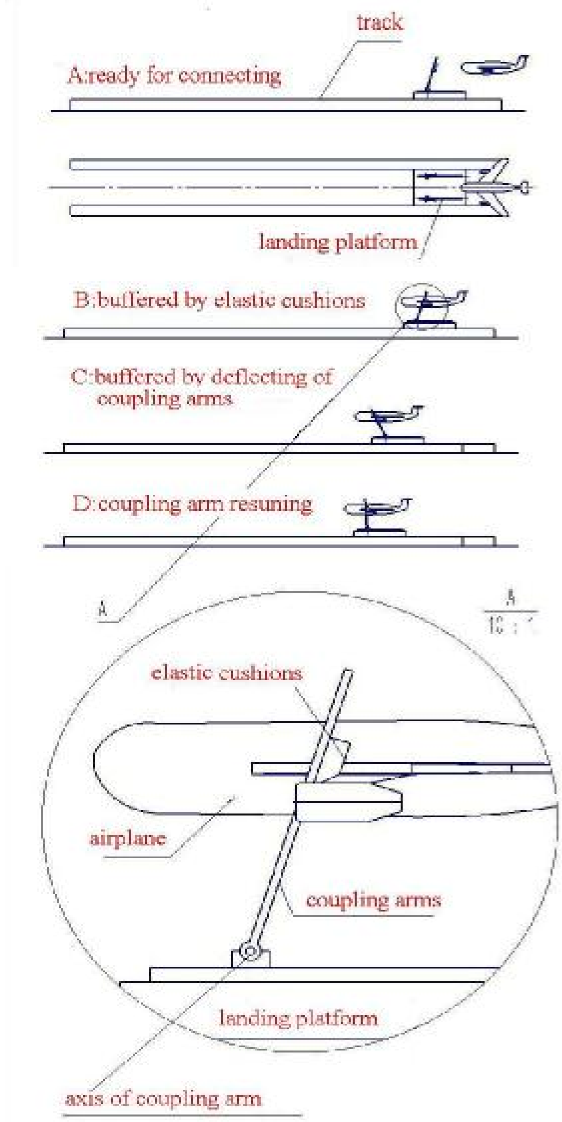

Fig.1.The Sketch Map of Landing by Coupling Arm

The process of landing by coupling arms can be decomposed more than 10 steps as follows:

1 Connecting the airplane with the platform by radio: the airplane is connected with the landing platform on the end of track by radio,

when the airplane approaches the airport. Hereafter, the controlling power of the landing platform is relegated to the airplane from the airport, and the landing platform should be considered as a part of the airplane until the airplane takes off next time;

2 Testing the landing platform: the landing platform should be tested according to some instructions from the airplane. In order to save the length of the track, the mode of running to-and-fro should be chosen for the testing operation of the platform. The landing platform should be replaced, if it is out of the order;

3 Ready for acceleration: the platform is stopped on the start point of the track according to the instruction from the pilot of the airplane, when the platform pass all the test operations. Meanwhile, the airplane of approach is aligned with electronic track;

4 The fast accelerating of landing platform: the landing platform start to accelerate according to the airplane, when the airplane approaches the platform to a certain distance;

5 Ready for connecting: after the landing platform being accelerated and before it to connect with the airplane, the airplane still level flying should be several meters behind and several m/s faster than the platform. The coupling arm is upraised to a destining position, and the elastic cushions on coupling arm is also risen to suitable position for coupling with the airplane;

6 Buffered by the elastic cushions: the wings of the airplane touch the elastic cushions on the coupling arm, when the airplane is caught up with the landing platform. The wings compress the elastic cushions and make the coupling arm to accelerate. Meanwhile, the airplane starts to decelerate according to the reaction of the coupling arms;

7 Last landing resolution: The pilot in airplane decide finally whether landing on the airport this time according to the status of the airplane and the platform. The coupling arm is put to being level on the platform and the platform is accelerated, so that it is escaped from the contact with the airplane, if the status is not suitable for landing this time. In the other hand, the landing process will be continued;

8 Buffered by the deflecting of the coupling arms: the coupling arm is deflected around the axis on the platform, according to the compress of the airplane;

9 Buffered by acceleration of the landing platform: the landing platform can be accelerated for lowering the difference of velocity between the airplane and the platform, if necessary;

10 The airplane resuming: the airplane with the coupling arm is probably beyond the landing platform, when the both of the speed are the same after the buffers above. In this case, the coupling arms should be re-deflected so that the airplane is at a correct position above the platform, before the speed of the airplane is so slow that it has landed on the platform;

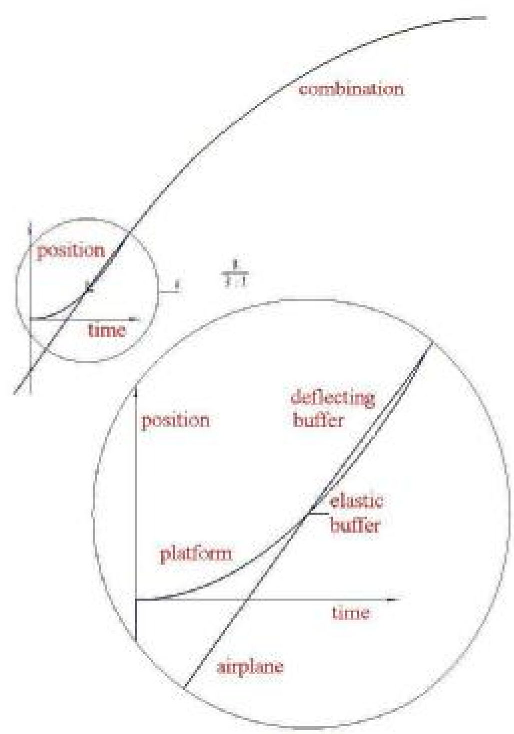

Fig.2. The Positions-Time Diagram of Landing by Coupling Arm

11 The combination decelerating by track: the airplane and the platform are braked by the electrical power track, when the projections of both the airplane and the platform are joined up. The braking force on the airplane is acted through the coupling arms;

12 Reducing the altitude of the airplane: the lift force on the airplane will drop, when the speed of the airplane is letdown. The incepting arms should be risen gradually from the landing platform for airplane can be touched fair and softly; the altitude of the incepting arms should be letdown gradually, so that the airplane can land on the platform fair and softly at last;

13 The coupling arm resuming: after the airplane landing on the platform, the coupling arm should be put level, turn into "not work" place;

14 End of the landing process: the wheels in the platform should be unfolded from the landing platform when the velocity of the combination is reduced, so that the combination of the airplane and the platform could leave from the electrical power track.

A general situation of landing process by coupling arms has been described approximately above. The concrete operation of landing by coupling arms should be much more detailed than that being described above. Naturally, the concrete operation must be confirmed according to factual design of the airplane with separable landing system.

4 Some Criterions on Landing by Coupling Arms

Instead of common airplane with the retractable undercarriage unfolds its landing gear down to ground, the separable landing system unfolds the coupling arm from the landing platform up to the plane, when the airplane lands to an airport. In fact, the concept of landing by coupling arms can not be understood as an old concept that the airplane lands on the platform.

Speaking resumptively according to last section, the process of landing by coupling arms can be seen as that the airplane, which flies above the electrical track in the low altitude, is seized back to the ground by the coupling arms on the landing platform.

Seeing from the standpoint of the mechanics, the fast accelerating of landing platform, coupling with airplane, and, buffered by the deflection of the coupling arms are three *material* steps of landing by coupling arms for "seizing" the airplane.

The interval passed for the platform accelerating from static state to the step "ready for connecting". According to principle of mechanics, the faster the acceleration, the shorter the distance of synchronization. Fortunately, there is no specific confine on the value of the acceleration in the step of fast accelerating of landing platform, since there is no person on the landing platform. As we think, the distance of synchronization can be limited within 100 meters, if the upper limit of the acceleration in the step is chosen at the3-5 times of g, the gravitational acceleration of the Earth. A restrictive factor is power of the landing platform, if the velocity of the landing airplane is V_{plane}, the mass of the platform is M_{pf}, and the acceleration of the platform is A_{pf}, and the peak value of the power P_{pv} is:

$$P_{pv} = M_{pf} A_{pf} V_{plane} \qquad (1)$$

If the mass of the platform is 80 tons, which is considered to bear a airplane with 150 tons weight, the acceleration is 5g, and the velocity of the landing airplane is 60 m/s, the peak value of power is about 30000 kilowatts.

After the fast accelerating of landing platform, the difference between the speed of the airplane and that of the landing platform is a delicate problem before the airplane connects with the coupling arms.

The airplane could not catch up with the airplane, if they moved at the same speed. The larger the difference between the airplane and that of the platform, the shorter time for the airplane to catch the coupling arms on the landing platform, and the shorter the road for the airplane to catch up with the arms. Certainly, the mechanical state of the airplane and the coupling arms must be considered carefully, when the difference of the speeds is chosen.

Although the beginning of the connection of airplane with the coupling arm is called as "buffered by the elastic cushions", the coupling arms start to deflect in this phase, and the deflection is a kind of angular acceleration around their axis.

Because the velocity of the airplane is larger than that of the coupling arms, the pressure on the coupling arm will be enlarged at beginning time of the airplane touching the arms, then an angular acceleration around the axis is caused according to the pressure. The angular acceleration changes the angular movement of the arms, and the angular motion also changes the pressure on the arms. All of these can be analyzed as a problem of dynamics, although the process of analysis is some complicated. Using a simple harmonic model, the problem can be simplified under the principle of conversation of energy.

In order to simplify the problem, we suppose that there is no additional torque acted on the coupling arms in the step of buffered by the elastic cushions, except the torque acted by the airplane. Furthermore, we also assume that the process is a short course comparing with all process of landing by the coupling arms. Then, the relative position between the airplane and the platform can be considered to be unchanged in the step of buffered by the elastic cushions, and the motion of the airplane to the arm can be considered as an angular motion of the arm to the airplane around its axis. In this case, the problem can be simplified as a simple harmonic motion.

In the simple harmonic system, the element of inertia is the coupling arm, which can move around its axis, and the element of elasticity is the elastic cushion, which brings a torque around the axis. When the cushion is compressed, the equation of motion of the coupling arm can be shown as:

$$I\,(d^2\theta/dt^2) = -\beta\,\theta \qquad (2)$$

Where θ is the angle around the axis of coupling arm, the zero point is the position of the arm when it touches the elastic cushion and the cushion is not compressed, I is the moment of inertia of the coupling arm around its axis, β is the elastic coefficient of torque around the arm's axis from the elasticity of the cushion.

If the deformation X of the elastic cushion is proportional to press F from the airplane, and the proportional coefficient is k, when the airplane is in the altitude h, the torque M to the arm around is:

$$M = F\,h = -k\,X\,h \qquad (3)$$

For the deformation X, the angle θ around the axis of coupling arm is:

$$\theta = X/h \qquad (4)$$

Then, we obtain:

$$\beta = M/\theta = k\,h^2 \qquad (5)$$

So the dynamical equation of the simple harmonic system can be shown as:

$$I\,(d^2\theta/dt^2) = -k\,h^2\,\theta \qquad (6)$$

the angular frequency of the simple harmonic system is $(k\,h^2/I)^{1/2}$

If the difference between the airplane and the platform is ΔV, the relative angular velocity at beginning is:

$$(d\theta/dt)_{t=0} = -\Delta V/h \qquad (7)$$

According to principle of conversation of energy:

$$(1/2)\,I\,(d\theta/dt)_{t=0}^2 = (1/2)\,\beta\,\theta_1^2 \qquad (8)$$

where θ_1 is largest swing of the simple harmonic system. Then we have:

$$\theta_1 = (I/\beta)^{1/2}\,(d\theta/dt)_{t=0} \qquad (9)$$

According to (5):

$$\theta_1 = (I/k)^{1/2}\,(\Delta V/h^2) \qquad (10)$$

Then we can obtain the largest deformation X_1 of the cushion:

$$X_1 = (I/k)^{1/2}\,(\Delta V/h) \qquad (11)$$

And the corresponding pressure P_1 on the coupling arms:

$$P_1 = (k\,I)^{1/2}\,(\Delta V/h) \qquad (12)$$

We can see the largest pressure between the airplane and the platform in the step of "buffered by elastic cushions " is proportional to the difference of velocity between them, and inverse proportional to the altitude of the airplane. If the proportional coefficient k of the cushion and the moment of inertia I of the coupling arm are determined, the difference of velocity between the airplane and the platform can be determined according to the largest pressure, of which the airplane can bear:

$$(k\,I)^{1/2}\,(\Delta V/h) < \kappa\,M_{plane}\,g \qquad (13)$$

where κ is a ratio, ($\kappa\,M_{plane}\,g$) is a working pressure between the arm and the wing of the airplane, with which the airplane and the people in the airplane can bear. In this case, we can obtain a dynamic criterion on difference of velocity between the airplane and the landing platform:

$$\Delta V < \kappa\,h\,(k\,I)^{-(1/2)}\,M_{plane}\,g \qquad (14)$$

For example, the M_{plane} is 200 dons, κ is 0.5, then we know that the working pressure is 10^6 N, if the altitude of the airplane h is 15miters, if the largest deformation X_1 of the cushion is 50 cm where the pressure is equal to 10^6 N, then we obtain:

$$k = 2 \cdot 10^6 \text{ N/m} \tag{15}$$

In a simplified case, the coupling arm is assumed to be a long and even rod, then its moment of inertia:

$$I = (1/3)\, m\, l^2 \tag{16}$$

Where the m is the mass of the coupling arms, l is the length of the coupling arm. If m is 4 tons, and the length is 20 meters, so the I is $5.2 \cdot 10^5$ kg m^2 ,

Then we obtain,

$$\Delta V < 15 \text{ m s}^{-1} \tag{17}$$

It is obviously, the difference ΔV can be enlarged, if an additional torque is acted on the coupling arm to strengthen its angular acceleration by the platform.

After the step "buffered by the elastic cushions", the coupling arms obtain actually an angular velocity equal to ($\Delta V/h$). The angular velocity must be absorbed subsequently in the step buffered by the deflecting of the coupling arms. Otherwise, the airplane will exceed the platform and be failed to connect with it. In fact, this means that the difference of the velocity ΔV must be absorbed in subsequent steps.

The distance S allowed for absorbing the deflection can be shown as:

$$S = 2\, h \tan(\alpha/2) \tag{18}$$

where α is the largest angle of the arm to be deflected.

The difference ΔV will be absorbed by three forces, one is the force f_{11} acted on the airplane by the coupling arm, another is the force f_{12} on the platform by the airplane through the coupling arms, the third is the additional force f_2 on the platform acted by the power track. The accelerations are a_{11}, a_{12} and a_2 accordingly. The value of f_{11} is equal to that of f_{12}, so we have:

We have approximately:

$$S \leqslant (1/2)(a_{11} + a_{12} + a_2)\, t_1^2 \tag{19}$$

And:

$$\Delta V = (a_{11} + a_{12} + a_2)\, t_1 \tag{20}$$

where t_1 is the time needed for accomplishing the step buffered by the deflecting of the coupling arms, we have:

$$2\, h \tan(\alpha/2) < (1/2)\, (\Delta V)^2 / (a_{11} + a_{12} + a_2) \tag{21}$$

Then, a kinetic criterion on difference of velocity between the airplane and the landing platform can be shown as:

$$(\Delta V)^2 \leqq 4(a_{11} + a_{12} + a_2) h \tan(\alpha/2) \tag{22}$$

The acceleration of the airplane is limited by the pressure between the airplane and the arm, and the largest value a_{11} is:

$$a_{11} \leqslant \kappa g \tag{23}$$

The coupling arms lead an interaction between the airplane and the platform when the airplane superposes the platform. The interaction makes the airplane decelerate, and make the platform accelerate. Certainly, the synchronizing process is an interesting course. Since the f_{12} the counterforce of f_{11} , so the value of a_{12}, so we have:

$$a_{12} \leqslant -\kappa\, (M_{plane} / M_{pf})g \tag{24}$$

so we obtain a kinetic criterion for landing by coupling arms:

$$(\Delta V)^2 \leqq 4\, [\kappa\, (1 + M_{plane} / M_{pf})g + a_2\,]h \tan(\alpha/2) \tag{25}$$

If we choose $\kappa = 0.5$, $(M_{plane} / M_{pf}) = 4$, $a_2 = 4g$, and $h = 15$m, $(\alpha/2) = 30$ degree, then, we obtain:

$$(\Delta V)^2 \leqq 2250 \text{ (m/s)}^2 \tag{26}$$

that is:

$$(\Delta V) \leqq 47 \text{ (m/s)} \tag{27}$$

According to the example above, the kinetic criterion on the difference of velocity between the airplane and the landing platform is softer than that of dynamics.

5 The Way to More Secure and More Economic Aviation for Future

All parts of the retractable undercarriage, including the wheels, the pillars and the device of liquid pressure , are the non-neglectable source of trouble when the airplane flies in the air. It is an emergency that the landing gear of airplane flying in the sky is out of order. On the other hand, the separable landing system can be replaced, if it is out of order before the airplane lands to ground.

Comparing with the retractable undercarriage, there is no obvious limitation on the weight for the separable landing system, hence, the function of the separable landing system can be designed more overall and reliable, and can be maintained more carefully, since the separable landing system is kept on the airport constantly [2].

In fact, the advantages of the separable landing system in the aspect of safety for aviation are more than the aspects above.

More than 50 percent of accidents happened in the processes of landing down and taking off, according to the current data of aviation.[]

The shortage of lift force in the process of taking off is a serious hidden trouble for the airplane, and this causes a lot of air crushes. The additional thrust from the electrical power track can be made strong enough for the airplane getting an appropriate velocity to take off, and this will lead the airplane safer in the process of taking off, if the technology of the separable landing system is used for future aviation.

It is different from that the airplane with the retractable undercarriage must be decelerated and its wheels must touch the ground, the airplane with the separable landing system needs not to be decelerated and lowered to zero altitude of the ground, when it connects with the coupling arms. The state of landing without floating down is beneficial for the repeating flight of the airplane, when the airplane meets urgent circumstance in the process of landing.

It can be expected reasonably that the half of air crash nowadays in the process of taking off and landing down can be avoided, if the separable landing system is applied in the future aviation.

The fuselage of the airplane can be made to be tougher for forced landing outside airport, if the separable landing system is used for future aviation, since the cabins of the retractable undercarriage are omitted.

Many people suggest that the passenger cabin of should be capable to escape from the airplane, if the airplane is in extreme dangerous state. The airplane with separable landing system is beneficial for the cabin to escape, if the high-set wing is also considered for the future airplane.

It is obvious that the weight of structure of the airplane will be reduced about 15%, if the landing gear is repealed from the airframe. [3]

In fact, the economical advantages of the separable landing system are more than that the weight of the airplane is lightened.

The retractable undercarriage must retract in the fuselage of common airplane, although it is only used within the airport. In general, the cross section of the fuselage, where the retractable undercarriage is installed, is near to the largest windward cross section, so the retractable undercarriage is still a obstacle to minish the flying resistance for airplane, although it has been retracted into the wheel's cabin. In order to retract the landing gear, several uncorks must be made for the wheel's cabin, although the central part of fuselage undertakes the largest stress of the airplane. The collocation of the retractable undercarriage is often a quite difficult task for the total design of an airplane[2].

The cabin of wheels will be omitted naturally, if the separable landing system is used. So we can see, not only the flying resistance can be minished in some degree, but also the total design of the airplane can be simplified and optimized, and the weight of the fuselage can be lightened in some degree.

As we know, the largest thrust of the engine is chosen according to taking off, when a common airplane is designed. In the other hand, an additional thrust can be provided from the electrical power track in the process of taking off, if the separable landing system is chosen for the future airplane. In this case, the engine of the airplane can be determined according to the demand from cruising and climbing in the air, so the engine with good function and high-efficiency can be chosen for the airplane.

The cost of fixture on the airport will be rising, since the electrical power track and the landing platform must be constructed for the separable landing system.

Nevertheless, the cost of producing the airplane can be reduced, since the retractable undercarriage is abridged, which must fly into air with the airplane ever. Furthermore, the thrust reverser no longer needed, so the design of engine can be simplified and optimized, this is also beneficial to lower the cost of producing the airplane.

In the aspect of cost of maintaining the airplane, the cost of separable landing system should be lower than that of common landing gear, since the aviation tyre and the material for brake can be reduced at least. The maintenance of landing platform is also needed, nevertheless, this is a kind of easier maintenance, since the device is always on the airport and needs not to go up air.

The concept of separable landing system is probably useful for development of supersonic passage, since the weight and the space of the landing gear is a more sensitive problem for the supersonic passenger airplane.

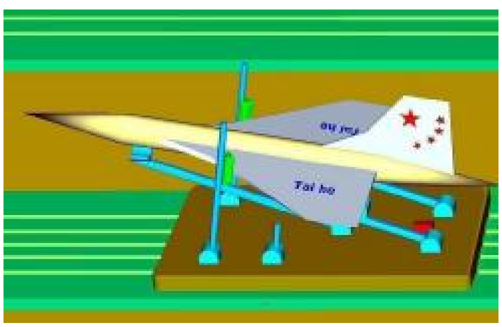

Fig.3. The Sketch of Supersonic Passenger Airplane with Separable Landing System

It is shown in Fig.3 that the supersonic airplane is landing by coupling arms, when the wings touch the elastic cushion on the coupling arm. The landing platform has been accelerated on the main track, and there is a backup track by the side of the main track.

Certainly, the design of the separable is not suitable for military use, since the large and complicated equipment, the electrical power track and the landing platform in airport is easy to be attacked.

6 Airtrain: the New Concept Is Helpful for Development of Heavy Airplane

In general, the technical bottleneck of developing heavy airplane is the runway in airport. The heaviest airplane in the world is A-225, of which the gross take-off weight is about 625 tons. The heavier airplanes can be designed and produced, but there is no runway to bear them.

The runway bottleneck of heavy airplane can be broken by the concept of separable landing system.

The technology of separable landing system is capable to make that an airplane of 6000 tons weight takes off and landing within 1500 meters, if the landing platform is driven by linear electronic motor and borne by steel wheel with steel track.

We can call such airplane as airtrain, because not only it is so heavy, but also it depends on steel wheel and steel track as if a train in the process of taking off and landing down.

It is different from that the main usage of an airbus is a conveyance for travelers, the main usage of an airtrain should be a conveyance for bale. An important task for the airtrain is as a flight platform to send load into space. The airtrain to send load into space should be designed with the form of high-set wing. The bottom fuselage of the airtrain can be designed being uncorked, so that the rocket can be sent out easily from the fuselage of the airtrain in the air. The airtrain of 10000 tons of gross take-off weight would be capable to send a load of 250 tons into space one time, which is maybe useful in the task of human adventuring Mars.

7 Discussion and Conclusion

Many new problems should be researched carefully before the airplane with separable landing system. But, as we know, modern technique of position finding is accurate, modern technique of communication is effective, modern technique of power electronics is forceful and accurate, modern technique of controlling timely by computer is dependable. All of these constitute a solid foundation for separable landing system.

The airplane with the separable landing system can be considered as the airplane with a third generation of the landing system, an natural upgrade for the airplane with the retractable undercarriage.

So we want to say that under the modern technique background, the separable landing system is timely development for future aviation.

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