Evaluating Difficulty of Freestyle Maneuvers

by Tamara Koyn. 1992 Modified December 1999.

Freestylists are always inventing new moves, some are easy to perform and others are more difficult to perform. By becoming familiar with the fundamentals of difficulty, a freestyle judge will be able to observe any move and be able to formulate an educated view about how difficult or easy the move is. Following the notion of these fundamentals, a judge will not need to look up moves from a database which may contain hundreds of moves. However, it is a good idea to review such databases of moves just to confirm that all factors of difficulty are being considered in this fundamental approach. It is possible that a new factor for difficulty can be discovered and added to the list. However, as moves are being invented, no list of difficulty factors could possibly grow as quickly as list of freestyle moves would.

This document lists fundamental difficulty factors for freestyle moves, additional notes on application, and difficulty factors for camera flyers in a bonus section.

For each difficulty factor, there is a description of that factor and examples of freestyle moves involving that factor. The placement of the example moves follows a format in which easier to perform moves are closer to the left side of the page with the more difficult moves more and more indented towards the right side of the page according to their relative difficulty only for the particular difficulty factor being described. Some move names are given in parentheses. While experienced freestylists may be familiar with these names and and these names can be a useful reference for you, you do not need to memorize a table or maneuvers for understanding the difficulty factors. To become more familiar with how the difficulty factors can be applied to various moves, the reader is also encouraged to refer to the "Difficulty Evaluation Guide" by Dale Stuart for more in-depth examples.

Easy: Move Has no Basics
Difficult: Move Has a Long Learning Progression

Some moves do not require previous experience and can be learned quickly. For example, the Tee can be learned by most novice skydivers. Other moves require the freestylist to be able to perform simpler moves before they can achieve more complex moves. For example, turning the Tee while changing the legs simultaneously requires the ability to perform the Tee Pose and turns in the Tee. A freestylist must devote more time to training for progressing from simpler moves to more complex moves. More complex moves have a longer trail of simpler moves and therefore require more training, thus they are regarded as being more difficult.

Examples:

- Tee Pose
  - Tee Turns
    - Tee Turns and changing legs
      - Tee Turns, changing legs, and barrel rolling in a coordinated well-timed manner
- Tee Pose
  - Barrel Rolling the Tee Pose (Tee Roll)
    - Barrel Rolling the Tee Pose while changing leg position (Arabian Roll)
- Layout Backloop and Frontloop
  - 1/2 Twist
    - Full Twists
      - Double Twists

Easy: Moves Executed Individually
More Difficult: Moves Executed in Flowing Sequence
Most Difficult: Difficult Moves Executed in Flowing Sequence

While performing a sequence of moves, the freestylist must anticipate the next move while still performing the previous. Stopping between every maneuver is the easiest way to perform a routine. It is more difficult to make moves flow together in sequences and well-connected routines. The higher the difficulty of the previous move, the more difficult it is for the freestylist to anticipate the next move. On the other hand, it is quite easy for the freestylist to use some simple move or position as a place to "rest" in order to mentally prepare for a more challenging move. It is more difficult to sequence together a series of difficult moves than a series of simple moves.

Easy: One Action at a time Occurring
More Difficult: Multiple Actions Occurring Simultaneously
Most Difficult: Multiple Actions Occurring in a pre-choreographed coordinated manner

When performing moves with multiple actions occurring simultaneously, the freestylist is challenged in his ability to maintain awareness of what is happening and to coordinate complex movements. It is the easiest to perform one rotation at a time. It is easier to make two rotations happen simultaneously in random coordination than it is to make two rotations happen in a pre-determined choreographed manner, such as exactly 1 1/2 twists during one complete loop. Adding coordinated fancy legs movements increases the difficulty even more.

Examples:

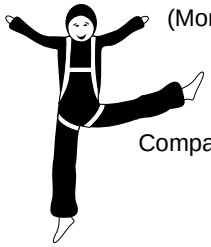
- Layout Backloop
  - 1/2 Twist loop
    - Full Twist Loop
      - Twisting combined with scissoring the legs
- Flat Turn
  - Turns and barrel rolls combined randomly (Propeller)
    - Exactly one turn per barrel roll performed (Flip Throughs)
      - Exactly one turn per barrel roll with scissoring leg motion (Thomas Flairs)
- Tee Barrel Roll
  - Tee Barrel Roll and changing legs
- Tee Loops
  - Tee—1/2 Twist FL to Tee
- Daffy Pirouette
  - Daffy Pirouette and changing legs

Easy: Symmetrical Body Shape
Difficult: Asymmetrical Body Shape

When holding an asymmetrical body shape, the freestylist often must aerodynamically compensate for the position to maintain heading control and/or balance on the horizontal axis. It is easier to allow asymmetrical positions to spin or turn than it is to hold them on heading. A symmetrical body shape is easier to balance and hold on heading.

Examples:

Straddle Standup

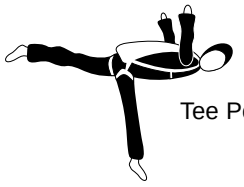


(More difficult to hold balance on horizontal axis)

Compass

(More difficult to hold heading—especially if the knee is facing away from the body)

Daffy



Tee Pose

Easy: Move requires little strength
Difficult: Move requires much strength

If a move requires strength, then a freestylist must have sufficient strength to perform the move or s/he will fail to perform the move well. For example, tucking into a smaller position while rotating requires the strength necessary to pull the parts of the body in closer against the centrifugal force. Fast spinning moves often require strength to prevent the force of the spinning from distorting the body position. (In today's 3-D skydiving disciplines, this difficulty factor is particularly present in skysurfing.) Some positions can require more strength to hold such as the case when forcing the legs to be spread wide while in a head-down pose.

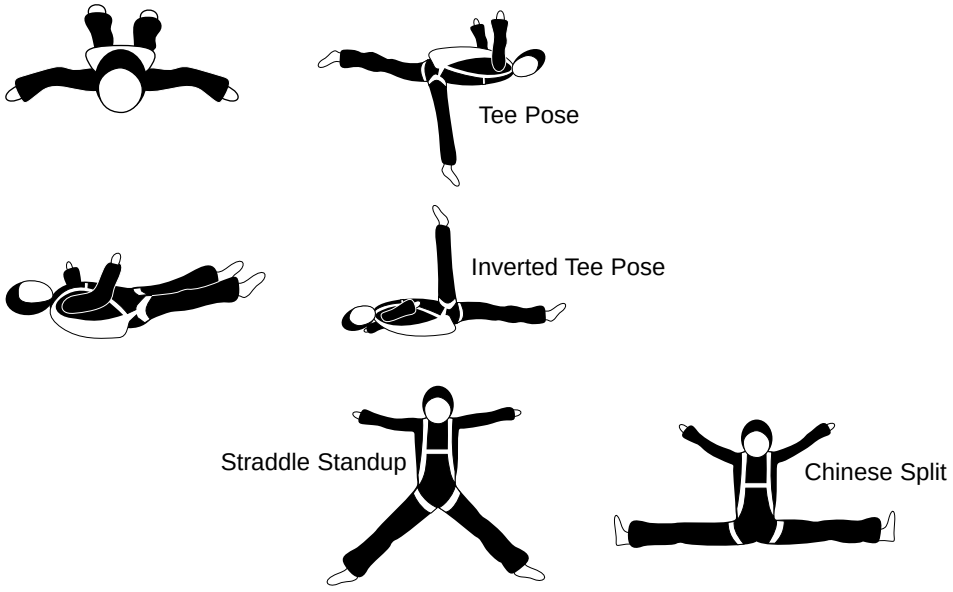
Examples:

- Standup Pirouette
  - Very fast standing and leaning forward spin with one leg raised and bent
- Layout Frontloops—change loop direction (Kick Back)—Layout Backloops
  - Layout Frontloops—change direction into tucked backloops
    - Layout Backloops into tightly tucked backloops
- Straddle Standup
  - Head-down Straddle Pose

Easy: No Flexibility Required
Difficult: Flexibility Required

If a move requires flexibility, then a freestylist must have sufficient flexibility to perform the move or s/he will not be able to perform the move. Achieving good flexibility requires training and dedication. The Tee requires more flexibility than just laying face down and the Chinese Split requires more flexibility than a Straddle Standup with a 90° angle between the legs.

Examples:

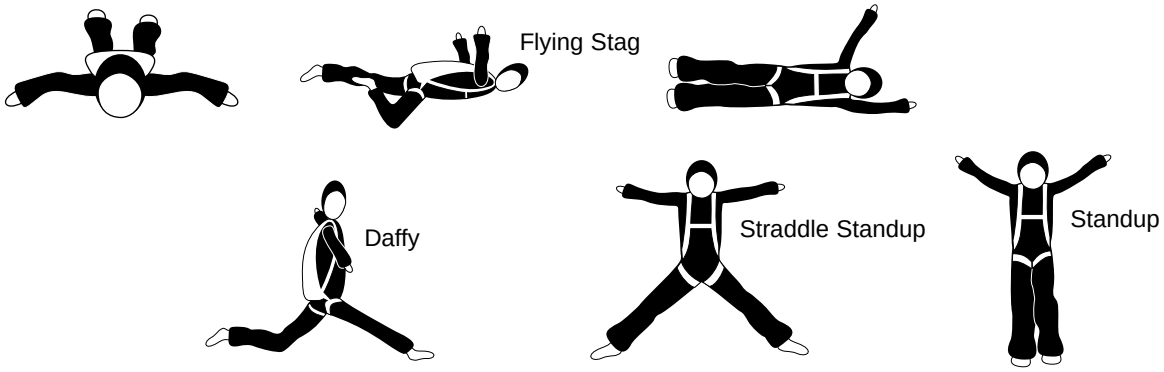


- Indian Seat Position (with legs crossed and folded in normal manner)
  - Lotus Position (with legs crossed and interlocked together with both feet on top of the knees)

Easy: Wide Base of Support (B.O.S.)
Difficult: Narrow Base of Support (B.O.S.)

With a narrow base of support (B.O.S.) in any direction perpendicular to the wind flow, it is more difficult to balance, i.e., to prevent falling in one direction or another. For example, in a Straddle Standup, the base of support is narrow from front to back and therefore the freestylist can fall forward or back more easily than he would in a Daffy. In a Daffy, having the arms spread to the sides keeps the freestylist from falling to either side and having the legs spread to the front and back keeps him or her from falling forward or backward. Performing a standup with both arms overhead would cause the base of support to narrow from front to back and side to side. To reduce the difficulty in standing up some freestylists will lean forward in order to widen their B.O.S. In the straddle Standup, some freestylists widen their B.O.S. from front to back by positioning the legs slightly forward and the arms backward.

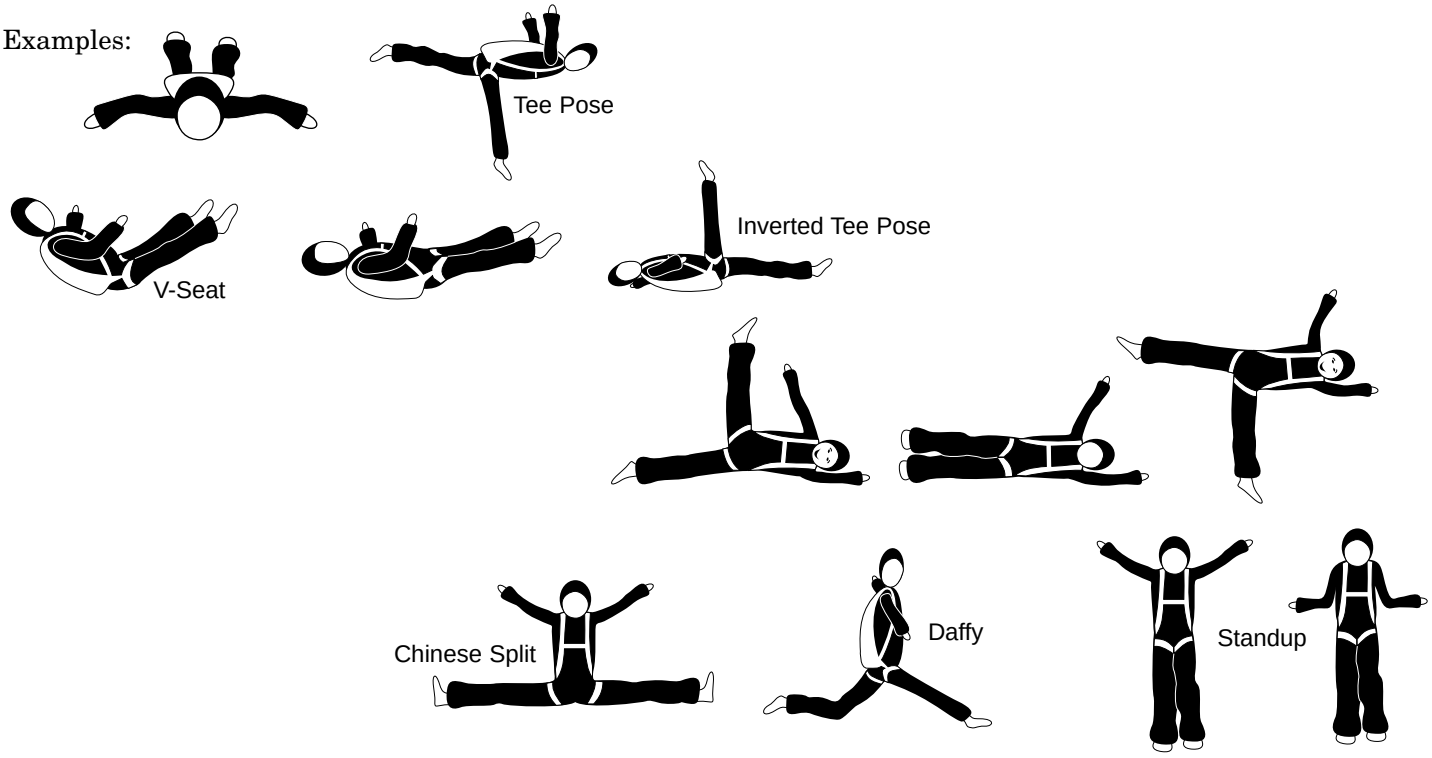
Examples:



Easy: C.G. Close to C.P. (Stable Position/Move)
Difficult: C.G. Far above C.P. (Unstable Position/Move)

When the center of gravity (C.G.) is farther above the center of pressure (C.P.), it is more difficult to balance (on both axes perpendicular to the wind flow). This explains why babies learn to crawl before they walk. The crawling position places the C.G. closer to the supporting surface and is, therefore, easier to balance than the standing position. The C.P. is technically that point where the aerodynamic forces support and effect the freestylist and is his or her supporting surface. A face down position is more stable and easier to perform than a standing or head-down pose.

Examples:



Easy: Passing through the point of Balance
More Difficult: Continuing to hold Balance
Most Difficult: Mastering Balance with shifting C.P.

It is easier for a freestylist to pass through a more difficult move to balance into another more stable move than it is for a freestylist to move from one more difficult move to balance to another. When the freestylist moves limbs toward and away from the body, the center of balance (C.P.) changes and makes it still more difficult to maintain balance without wobbling.

Example:
Standing Pirouette flowing into a flat move
One type of standing Pirouette flowing into another type of Standing move
Standing maneuver during which the leg(s) is (are) moved in and out or around

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Easy: Stationary C.P. (Center of Pressure)
Difficult: Moving C.P. (Center of Pressure)

If the C.P. is stationary during a pose or series of moves, it is easier for the freestylist to avoid wobbling or losing balance. If the C.P. moves radically (large change in location of C.P. in a very short instant in time) during a series of movements, then it is more difficult for the freestylist to avoid buffeting or losing balance.

Examples:
Holding a single back down pose (Inverted Tee Pose)
Rapidly changing legs from one pose to another while back down (Rockett Kicks)
Holding a single head-up pose (Stag Standup)
Continuously changing the pose of the legs while head-up (Stag Kick Turns)

Easy: C.G. and C.P. are aligned within the B.O.S.
Difficult: C.G. and C.P. are aligned at the "edge of the B.O.S." with limbs at limit of R.O.M.

It is possible for freestylists to achieve a balanced state with body parts completely at one end of the range of movement (R.O.M.). This puts the freestylist in a state of having to maintain balance without being able to move a limb in a particular direction to compensate. These types of moves are more difficult than ones which do not involve the limbs being placed completely at the limit of the range of movement. An arched head-down position with both the lower and upper body arched backwards away from the vertical line is difficult to balance due to this factor. A piked position with the seat to the wind and leaning forward (Shrimp Track) is also more difficult due to this factor.

Easy: Tumble Rotation in less stable position
Difficult: Tumble Rotation in very stable position

Because of the stability present in extremely stable positions, it is more difficult to make these positions rotate about a horizontal axis. Such extremely stable positions have the C.G. positioned completely to one edge of the body mass such as the case in an Indian (or Lotus) sitting position with legs crossed and the pike position.

Example:
Barrel Rolls with body straight
Barrel Rolls with body arched
Layout BackLoops
Backloops in with legs interlocked in Lotus position
Tucked Backloops
Piked Backloops

Easy: Body Parts held close to the Axis of Tumble Rotation
Difficult: Body Parts held away from the Axis of Tumble Rotation

With a narrow base of support on the axis about which the rotation is performed, a rotation about the horizontal axis is easier to perform. When limbs are extended farther from the axis of rotation, they cause resistance to the rotation and make the move more difficult. When the legs are extended farther from the axis of rotation, even pointing the feet adds to this resistance and the difficulty of performing the move.

Example:

Barrel Rolls with body parts kept close to the roll axis (Barrel Rolls)
Barrel Rolls with body parts spread out wide symmetrically (Straddle Rolls)
Barrel Rolls with body parts spread out wide in asymmetrical manner (Y-Scale Rolls)
Tucked Backloops
Layout Backloops

Easy: Movement proceeds at average speed
Difficult: Movement proceeds very quickly/slowly

To perform a move or move sequence extra slow or extra fast requires the freestylist to exert more control of the sequence as opposed to allowing it to happen. This also may apply to moving body parts as well. If one must make a large movement with a large body part quickly to accomplish a move such as getting the legs changed from one widely spread position to another in an instant of time, this increases the difficulty in performing the move.

Examples:

Any maneuver performed at an average moderate rate of motion
That same maneuver performed in extreme slow motion
A 1/2 twist performed during one loop
A “slow motion” 1/2 twist performed evenly performed over a span of 3 loops

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Easy: Maintaining the same momentum
Difficult: Changing the direction/state of momentum

Moves with the same rotation speed and direction can be more easily linked together than moves requiring different rotation speeds and direction.

Example:

One average speed move flowing into the next
Average speed move, instant stop and hold, snapping into a high speed spin

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Easy: Impulse Movement (about horizontal axis)
Difficult: Sustained Movement (about horizontal axis)
Easy: Sustained Movement (about vertical axis)
Difficult: Impulse Movement (about vertical axis)

An impulse movement is one during which the freestylist exerts a force and then coasts through the duration of the movement to its finish. Examples include throwing Barrel Rolls and Back Loops. A sustained movement is one during which the freestylist exerts a continuous force and controls that continuous force throughout the entire move. Performing an impulse movement about the vertical axis, such as a snappy style tuck turn on heading, is more difficult than performing a sustained movement about that same axis. Performing a sustained movement about one of the horizontal axis is more difficult than performing an impulse movement about that same axis. Performing layout backloops in slow motion is one example.

Easy: Rotational axis remains at the same angle with respect to relative wind
More Difficult: Rotational axis changes with respect to relative wind
Most Difficult: Rotational axis changes slowly with respect to relative wind during the move sequence.

It is easiest for a freestyle performer to transition into another movement continuing with already established momentum. It is more difficult for a freestylist to suddenly change the momentum with respect to the relative wind (momentum about a horizontal axis changed to motion about a vertical axis or vice-versa) and farther more difficult to slowly change the rotational axis with respect to the relative wind.

Example:
One vertical backlooping move into another type of backlooping move
A vertical backlooping move into a horizontal twisting move
A side backlooping move (Pinwheel) slowly tipping to a vertical backlooping move (Daffy BLs)

Easy: Move performed at terminal velocity
Difficult: Move performed during exit transition

Any move performed during exit transition requires a keen understanding and feeling for the relative wind. A difficult move, i.e., a move that rates high on one or more other difficulty factors, is more difficult when performed on the hill especially if it is the first move immediately when exiting the aircraft. Also, the exit speed can effect the difficulty and controllability of moves. With slower exit speeds, one can utilize other means of control such as action-reaction, etc. Also, during the exit, momentum can be gained by the manner in which the performer pushes off from the plane. Observe that some freestylists may find some moves easier to perform during exit transition than at terminal velocity.

Example:
A standup maneuver performed at terminal velocity after exit transition
That same standup maneuver performed during exit transition

Easy: Moving from a move of a faster terminal velocity to one with a slower terminal velocity
Difficult: Moving from a move of a slower terminal velocity to one with a faster terminal velocity

If a freestyle performer transitions into a slower falling move from a faster falling move, he has more airspeed and therefore more control of the move he is transitioning to. When the freestylist proceeds to a faster falling move from a slower falling move then control is more precarious. The following move is like flying in subterminal conditions. This is the case for an experienced freestylist. If the freestylist is not familiar with the particular skill involved then this difficulty factor may work in the reverse manner. Also, this factor is subject to the varied preferences among freestylists.

Example:
A standup move into a face down move
A spread out Daffy move transitioning into a really stream-lined standup move

Concluding Notes

With all other factors equal, each of these difficulty factors describes the difficulty level of a move. However, in the real world of freestyle all factors are rarely equal. For example, the Chinese Split is more difficult than a Daffy in terms of a narrow B.O.S. from front to back whereas the Daffy is more difficult than the Split in terms of the C.G. being carried higher over the C.P. The Chinese Split requires more flexibility. But the Daffy is more difficult than the split in terms of symmetry. Examining all the difficulty factors for both poses indicate that both positions seem to have a similar difficulty. As another example, if a vertical looping action starts and ends in an unstable position with the C.G. high above the C.P, it is harder than a vertical loop that starts and ends in a stable flat pose.

Note that moves that rate more difficult according to more than one factor are, in general, more difficult than those that are difficult according to only one factor.

The design of jumpsuits, head position and movements, arm position and movements, and/or using props all effect the difficulty of various moves.

Jumpsuit Design: If the freestylist is wearing a jumpsuit with winglets on the arm designed to catch air in the standing orientation then the C.G. is not as far above the C.P. in a stand up as it would be if the freestylist were wearing jeans and a sweat shirt. The extra drag from the arm winglets also decrease the fallrate making the freestylist easier for the camera flyer to film. However, using these winged jumpsuits effectively require the freestylist to be strong in the arms. It is easy to allow the arms to be swept upward at an angle but more difficult to keep them pressed down into the wind to maintain that slower fallrate for the camera flyer. If the wings are larger more like those on sit suits, they can increase the difficulty in performing vertical loops as it is more difficult to loop inherently stable positions.

Head position and movement: Arching the head back, closing the eyes (or wearing a blind fold), performing inside clouds, jumping at night especially while blinded by camera lights, and dizziness due to multiple rotations in the same direction for the head all cause a loss of or unreliable eye contact with the horizon and ground. This increases the difficulty in balancing especially for those moves which involve having the C.G. higher above the C.P. and/or a narrower base of support. This also increases the difficulty in accurately perceiving heading control.

Arms: Taking the arms away from the horizontal position while performing head-down moves can increase the difficulty as this requires more leg strength to maintain the position of the legs. But even more so, using distorted arm positions or holding another body part with an arm increases the difficulty in balance and maintaining heading for many moves. In these positions, the performer can not use the arms as much for controlling balance. Often, such use of the arms either can reduce the B.O.S. and/or cause a pose/move to become more asymmetrical.

Props: Carrying props, handling props and/or the asymmetrical use of props can dramatically effect the relationship of the C.P. to the C.G. therefore causing unusual effects on the ability to balance. Props can also limit a freestylists mobility.

There are certain signs which reveal when a move is on the borderline of being too difficult for the freestylist. These include:

1) .....The legs do not remain straight and/or together throughout the move when they should be.
2) .....Bobbling or wobbling when finishing a rotational action or just wobbling in general.
3) .....Failing to make a strong crisp finish for a move.
4) .....Not finishing a move on the desired heading.
5) .....The arms/hands are moving about visibly and constantly compensating for balance.
6) .....Jerkiness, lacking fluidity, and/or hesitations throughout a move sequence.

To use these difficulty factors in judging, a judge should first familiarize himself with all of the factors by reviewing this document and, perhaps, also reviewing the “Difficulty Evaluation Guide” by Dale Stuart. Then, for convenience, he would write them down all in a short hand list for reference during a competition. To judge the difficulty, a judge views the freestyle routine noting the moves performed and then refers to his short hand reference sheet. The key question to answer is how much of each factor and how many of the factors were present in the routine. If every move was super difficult on every factor in the list, then the freestylist would receive the maximum difficulty score. This condition would be nearly impossible for any freestylist to meet and therefore perfect difficulty scores may not even be achievable. However, this system could provide a standardization so that every routine is judged according to same parameters by every judge in a consistent manner.

Evaluating Difficulty for Camera Flyers

by Tamara Koyn. 1992 Modified November 1996

Easy: Subject makes gradual changes in fallrate
Difficult: Subject makes sudden changes in fallrate

When an aerial routine does not contain radical changes in fallrate, it is easier for the camera flyer to maintain consistent proximity. A routine that contains radical changes in fallrate places greater demand on the camera flyer to anticipate the next move in order to maintain proximity (and avoid chasing the subject in reaction to falling behind the "power curve").

Example:

Easier: Subject performs a series of face down moves in a row.

More Difficult: Subject performs a flat move, then a standing one, then another flat one, and then a head-down one.

Easy: Camera Flyer films from a Consistent Angle
Difficult: Camera Flyer purposefully shoots a Variety of Angles

When a camera flyer must anticipate flying with the aerial routine and fly about the subject to capture various dramatic angles, he has a more difficult task to perform than he would if he were to film the entire routine from a level point of view with the horizon level in frame.

Example:

Easier: Camera flyer stays perfectly level with the subject's movements.

More Difficult: Camera flyer makes various passes by the subject, such as passing under a particular move, filming with the frame upside-down, orbiting about the subject in the vertical dimension, etc. (This 3-D flying is even more difficult if the subject is moving about the sky instead of falling straight down.)

Easy: Freestylist maintains a Medium Fallrate for more than 5 Seconds
Difficult: Freestylist maintains an Extremely Slow or Fast Fallrate for more than 5 Seconds

The average camera flyer will be dressed appropriately for and have the skills to fall at a medium fallrate between the slowest falling moves and the fastest falling moves (somewhat faster than the relative workers). However, if the subject holds an extremely slow falling position for over 5 seconds, the camera flyer must be able to actually maintain the slower fallrate (with consistent level/proximity control). Likewise, if the subject assumes the fastest falling positions for more than 5 seconds, the camera flyer must keep up with the fall rate to maintain consistent level/proximity control. A routine that has a full range of fallrates is more difficult for camera flyers to film than a routine that maintains a somewhat consistent fallrate (whether that be slow, standard RW rate, or fast). Camera flyers must acquire a large fallrate range by the aerial skills they have perfected and the proper selection of jumpsuit, weights, etc.

Example:

Easier: The aerial routine transitions from one move to another all at a medium fallrate such as Daffy Pirouettes to Straddle Pirouettes to a split and, finally, into Layout Backloops.

More Difficult: The subject holds a slow falling move and moves into another slow falling move such as the Tee Pose and then transitioning into Pinwheels.

Extremely Difficult: The aerial routine moves from one fast falling move to another such as transitioning from a Stag Pirouette to a Pirouette to a head-down Stag Pirouette and, finally, into the head down dive position.

Easy: Subject falls Straight Down
Difficult: Subject Slides about the Sky

A camera flyer must compensate for the subject who slides about the sky, intentional or not, by sliding with him to maintain consistent level and proximity control. For a subject that falls straight down, the camera flyer does not have to anticipate any sliding actions. This difficulty is farther increased if the subject is sliding at very slow or streamlined fallrates.

Example:

Easier: The aerial routine falls straight down.
Medium Difficulty: The aerial routine slides about the sky in a predictable manner.
More Difficult: The aerial routine slides about the sky in an unpredictable manner.
Extremely Difficult: The aerial routine slides about the sky in an unpredictable manner at very slow or streamlined fallrates. (Note that fallrate is described in other difficulty factors.)

Easy: Camera Flyer films from a Distance
Difficult: Camera Flyer films Close Up Shots

When a camera flyer films up close, he must more accurately compensate for the freestyle performer's changes in fallrate and sliding in the sky. If a camera flyer is using a wide angle lens, then he must fly close to the subject, hence, it is more difficult to film with a wide angle lens.

Example:

Easier: The subject is small in the frame.
Medium Difficulty: The subject fills the screen completely while the camera flyer uses a wide angle lens.
More Difficult: A part of the subject's body fills the screen.
Extremely Difficult: A part of the subject's body fills the screen as the aerial routine slides about the sky in an unpredictable manner at very slow or streamlined fallrates. (Note that fallrate and horizontal sliding are described in other difficulty factors.)