

CLAIMS

1. A tether management system comprising:
 - a spool rotatable to reel in and reel out a tether;
 - a tension sensor for measuring a tension of the tether;
 - a controller for receiving a desired tension of the tether and for controlling the rotation of the spool to reel in and reel out the tether based on a difference between a measured tension from the tension sensor and the desired tension of the tether; and
 - a moveable pulley disposed to engage tether between the spool and the tension sensor, the moveable pulley being able to be biased and moveable along a linear path to adjust a tension of the tether when the tension of the tether deviates from the desired tension.
2. A tether management system according to Claim 1, further comprising an elongated compression spring for biasing the moveable pulley along the linear path.
3. A tether management system according to Claim 2, further comprising a first rod over which the elongated compression spring is sleeved.
4. A tether management system according to Claim 3, further comprising:
 - a second rod at least substantially parallel to the first rod; and
 - a pulley support for supporting the moveable pulley, the pulley support including two bushings through which the first rod and the second rod penetrate to allow the pulley support to be slidable thereon.
5. A tether management system according to Claim 4, further comprising:
 - a first end block at a first end of the first rod and the second rod; and
 - a second end block at a second end of the first rod and the second rod; wherein the elongated compression spring has a free length that is substantially equal to a length of the first rod.

6. A tether management system according to Claim 5, wherein the elongated compression spring, when biased, has a force of about twice the tension of the tether over a range of operating tension of the tether.
7. A tether management system according to Claim 5, further comprising a limit stop disposed adjacent an intermediate position between the first end block and the second end block to limit movement of the pulley support to be along the first rod and the second rod between the second end block and the limit stop.
8. A tether management system according to Claim 1, wherein the thickness of the spool is in the range of 1-10 times the thickness of the tether.
9. A tether management system according to Claim 1, further comprising a housing having a base, a roof opposite the base and a sidewall between the base and the roof, and wherein the spool is disposed such that a radial plane thereof is at least substantially parallel to the base of the housing.
10. A tether management system according to Claim 9, further comprising:
 - a fixed pulley disposed to engage tether between the moveable pulley and the tension sensor;
 - a tension pulley for guiding the tether along an exit section of a path of the tether extending through the roof of the housing; and
 - wherein the tension sensor is coupled to the tension pulley to measure a tension of the tether.
11. A tether management system according to Claim 10, wherein the exit section is transverse to the linear path of the moveable pulley.
12. A tether management system according to Claim 10, further comprising:
 - a bracket to which the tension pulley and the tension sensor are mounted; and
 - a fairlead mounted to the bracket through which the tether exits the housing, the fairlead including at least one roller that is able to urge the tether against the tension pulley.

13. A tether management system according to Claim 1, wherein the controller is adapted to determine a speed for rotating the spool based on a difference between the measured tension of the tether and the desired tension.

14. A tether management system according to Claim 13, wherein the controller is adapted to further limit the speed for rotating the spool to a cap value corresponding to a length of tether left on the spool when less than a predetermined length of tether is left on the spool.

15. A tether management system according to Claim 14, further comprising a sensor for determining if an end of spool is near, and wherein the controller is adapted to set the speed to zero when the sensor indicates so.

16. A tether management system according to Claim 1, further comprising a guard disposed adjacent the spool to prevent tether slippage.

17. A method for managing tether on a spool, the method comprising:
receiving a desired tension for deployed tether;
measuring a tension of the deployed tether;
rotating the spool to reel in and reel out the tether based on a difference between the measured tension and the desired tension;
engaging the tether with a moveable pulley; and
biasing the moveable pulley to be moveable along a linear path to adjust a tension of the tether when the tension of the tether deviates from the desired tension.

18. A method according to Claim 17, the method further comprising determining a speed for rotating the spool based on a difference between the measured tension and the desired tension, and wherein rotating the spool includes rotating the spool at the determined speed.

19. A method according to Claim 18, further comprising limiting the speed for rotating the spool to a cap value corresponding to a length of tether left on the spool when less than a predetermined length of tether is left on the spool.

20. A method according to Claim 19, further comprising setting the speed to zero when an end of spool is detected to be near.

21. A method according to Claim 17, wherein biasing the moveable pulley comprises biasing the moveable pulley with an elongated compression spring having a force that is about twice the tension of the tether over a range of desired operating tension of the tether.