```
#include "CCE2_hamilton_v1.spec"

Problem Description
    title = TITLE
    type  = surface

/* Weights are in Newtons */


Analysis Parameters
    static-relaxation = 0.01
    static-iterations = 1000
    static-tolerance  = 0.001

    relax-adapt-up    = 1.02
    relax-adapt-down  = 1.1

    static-outer-iterations = 1000

    static-outer-relaxation = 0.98
    static-outer-tolerance  = 0.01
    static-initial-guess = catenary



    duration           = TF
    ramp-time          = RAMPTIME
    time-step          = DT
    dynamic-relaxation = 0.95
    dynamic-iterations = 500
    dynamic-tolerance  = 1e-6
    dynamic-rho        = -0.5

Environment
    rho              = 1025
    gravity          = 9.81
    depth            = DEPTH
        bottom-elevation = 0
    bottom-stiffness = 600
    bottom-damping   = 20

    x-current        = XCURRENT
    x-wind           = XWIND

    input-type = INPUT_TYPE

#ifdef WAVE_FOLLOWING
   forcing-method   = wave-follower
    x-wave = (XWAVEAMP, XWAVEPERIOD, XWAVEDIR)
#endif
#ifdef VELOCITY_FORCING
    forcing-method = velocity
    z-input = (XWAVEAMP, XWAVEPERIOD, XWAVEDIR)
#endif

Buoys
    atlas_buoy  type = cylinder /*Based off of the TAO-CO2 specs given by Taylor */
                m = 867
                d = 2
                h = 1
                buoyancy = 2542.4 /* kg */
                Cdn = 1.0   Cdt = 1.0
                Sw = 3.0   Cdw = 1.5     /* reduce area by 50% for ATLAS */
```

```
                                          /* relative to 3-meter discus   */

        cce2_2_buoy     type = cylinder
                m = 1900
                d = 2.3
                h = 1
                Cdn = 1.0
                Cdt = 1.0
                Cdw = 1.5
                Sw = 2                  /*Winded Surface Area, important for any surface probl
em (surface, deployment, etc.)*/
                buoyancy = 4007 * 9.81

Anchors
    clump

        five_wheel_stack

Connectors
    pivot       d = 0.01        /* to release moments - use segments mostly */
                m = 0.01
                wet = 0.01
                Cdn = 0.0
                length = 0.0

        pivot2          d = 0.01        /* to release moments - use segments mostly */
                        m = 1.5
                        wet = 1.5 * 9.81
                        Cdn = 0.5
                        length = 0.2

Materials
        Stretch_Hose EA = 5e4   EI = 1000               GJ = 1.0
                 d = .078      Cdn = 0.5       Cdt = 0.5
                 wet = 9.8*3.94/2              m = 3.94  /*These are rough guesses */
                type = nonlinear
                T = 11675*e*e-25086*e*e*e+19235*e*e*e*e
                Te = 2*11675*e-3*25086*e*e+4*19235*e*e*e
                Tee = 2*11675-2*3*25086*e+3*4*19235*e*e


        ESP_Assembly_ForCatenary   EA = 1e7     EI = 5e5        GJ = 1e5
                m = 490/1.5     wet = 10/1.5
                d = .762        Cdn = 0.5       Cdt = 0.5
                               /* Cat = .5       Can = 1.0 */
                                amt =  100/1.5       amn = 150/1.5

        ESP_Assembly_ForTaut   EA = 1e7 EI = 5e5        GJ = 1e5
                m = 730/1.5     wet = -1690/1.5
                d = .762        Cdn = 0.5       Cdt = 0.5
                               /* Cat = .5       Can = 1.0 */
                               amt =  300/1.5       amn = 450/1.5

        ESP_Can   EA = 1e7      EI = 5e5        GJ = 1e5
                m = 235/0.85    wet = -1540/0.84
                d = .762        Cdn = 0.5       Cdt = 0.5
                                Cat = .5       Can = 1.0

        BatteryCase     EA = 1e+7       EI = 5e5                GJ = 1.0
                m = 181.8/0.66  wet = 980/0.66
                d = .91         Cdt = 0.5      Cdn = 0.5
                                Cat = .5       Can = 1.0
```

```
        chain_5/8in      EA = 9.2e+07      EI = 1e-4         GJ = 1e-4
                 m = 5                         wet = 4.09 * 9.81
                 d = 0.0587       Cdt = 0.05       Cdn = 0.55
                                  Cat = 0.1        Can = 1.0

        chain_mr5/8in    EA = 9.2e+07      EI = 1e-4         GJ = 1e-4
                 m = 5                         wet = 4.35*9.81
                 d = 0.025       Cdt = 0.05       Cdn = 0.55
                                  Cat = 0.1        Can = 1.0

        adcp_frame           EA = 1.0e8     EI = 4.508e+06         GJ = 2.25e+06

                     m = 25               wet = 245/1.4
                    d = 0.5              Cdt = 0.05          Cdn = 0.5
                    length = 1.4

        nilspin_3/8in    EA = 4.944e+06  EI = 1.0        GJ = 1.0
                 m = 0.412                      wet = 3.04
                 d = 0.0127     Cdn = 1.5       Cdt = 0.005
                                Can = 1.0       Cat = 0.0

        nylon_1in        EA = 100084    EI = 0.01       GJ = 0.01
                 m = 0.214                     wet = 0.2551
                 d = 0.0254     Cdn = 1.5       Cdt = 0.005
                                Can = 1.0       Cat = 0.0

    depressor   EA = 5.0e7      EI = 10000.0            GJ = 10000.0
                 m = 151.1820                           wet = 1481.2577928
                 d = 0.290      Cdt = 0.01              Cdn = 1.0
                      Cmt = 1.26      Cmn = 2.0

        single_release     EA = 5.0e7         EI = 10000        GJ = 10000
                 m = 36         am=7.713           wet = 245
                 d = 0.5         Cdt = 1.0         Cdn = 1.0
                     Cat = 1.0        Can = 1.0
                      length = 1.0

        nystron_1in      EA = 748784     EI = 0.01       GJ = 0.01
                 m = 0.506                     wet = 0.9614
                 d = 0.0254     Cdn = 1.5       Cdt = 0.005
                                Can = 1.0       Cat = 0.0

    long_chain_3_4   EA = 5.0e7 EI = 10.0               GJ = 10.0
                 m = 6.6                        wet = 56.3094
                 d = 0.066      Cdt = 0.006             Cdn = 0.5
                                Cmt = 1.1               Cmn = 2.0

    short_chain_3_4   EA = 5.0e7        EI = 10.0               GJ = 10.0
                 m = 9.0                        wet = 76.8123
                 d = 0.066      Cdt = 0.006             Cdn = 0.5
                                Cmt = 1.1               Cmn = 2.0

     swivel_5T   EA = 5.0e7     EI = 1000.0             GJ = 1000.0
                 m = 6.2/0.23                           wet = 5.35/0.23 *9.81
                 d = 0.1        Cdt = 1.2               Cdn = 1.2
                      length = 0.23

        term_d            EA = 5.0e7      EI = 1e-4         GJ = 1e-4
                  m = 12.694                         wet = 107.922
                  d = 0.0805       Cdt = 0.05       Cdn = 0.55
                                   Cat = 0.1        Can = 1.0
                      length = .26
```

```
        chain_mr3/4in    EA = 9.2e+07      EI = 1e-4         GJ = 1e-4
                                m = 7.6                         wet = 6.61*9.81
                                d = 0.03       Cdt = 0.05       Cdn = 0.55
                        Cat = 0.1       Can = 1.0

        double_chain_mr3/4in    EA = 9.2e+07      EI = 1e-4         GJ = 1e-4
                                m = 7.6*2                         wet = 6.61*9.81*2
                                d = 0.03*2       Cdt = 0.05*2       Cdn = 0.55*2
                        Cat = 0.1       Can = 1.0

        sensor_cage           EA = 1.0e8     EI = 4.508e+06         GJ = 2.25e+06

                        m = 50/1.9                 wet = 25/1.9*9.81
                                d = 0.5                 Cdt = 0.05          Cdn = 0.5
                                /*length = 1.9*/

        pig        EA = 5.0e7   EI = 10000.0            GJ = 10000.0
                 m = 151.1820                           wet = 100 * 9.81
                 d = 0.290      Cdt = 0.01              Cdn = 1.0
                        Cmt = 1.26      Cmn = 2.0

        stud_chain_1in
                EA = 9.2e+07      EI = 1e-4         GJ = 1e-4
                                m = 14.3827                         wet = 12.51*9.81
                                d = 0.0905       Cdt = 0.05       Cdn = 0.55
                        Cat = 0.1       Can = 1.0


Layout
   terminal = {
      anchor = five_wheel_stack
   }


#ifdef CONFIG3  /*Taut mooring */
segment = {
        material = chain_mr3/4in
        length = 3
        nodes = (3, 1.0)
        }

   segment = {
      length = 85
      material = nilspin_3/8in
      nodes = (95, 1.0)
   }

#else  /* Chain Catenary Mooring (CONFIG1 or CONFIG2 or CONFIG4) */
segment = {
        material = chain_mr3/4in
        length = 90
        nodes = (90, 1.0)
        }

      connector = pivot2

segment = {
      length = 27.5
      material = stud_chain_1in
      nodes = (28, 1.0)
   }

        connector = pivot2
```

```
   segment = {
      length = 20
      material = nystron_1in
      nodes = (20, 1.0)
        }

        connector = pivot2

   segment = {
      length = 2
      material = chain_mr5/8in
      nodes = (6, 1.0)
   }
#endif

  connector = pivot2


   segment = {
      material = single_release
      nodes = (3, 1.0)
        }

#ifdef CONFIG3  /*Taut mooring */
connector = pivot2
   segment = {
      length = 2
      material = chain_mr5/8in
      nodes = (3, 1.0)
   }
#else  /* Chain Catenary Mooring (CONFIG1 or CONFIG2 or CONFIG 4) */
connector = pivot2
   segment = {
      length = 2
      material = chain_mr5/8in
      nodes = (3, 1.0)
   }
#endif

   connector = pivot2

   segment = {
      length = 250
      material = nylon_1in
      nodes = (250, 1.0)
   }

   connector = pivot2

   segment = {
      length = 270
      material = nilspin_3/8in
      nodes = (270, 1.0)
   }

          connector = pivot2

   segment = {
      length = 110
      material = nilspin_3/8in
      nodes = (220, 1.0)
   }
```

```
   connector = pivot2

   segment = {
      length = 1.9
      material = sensor_cage
      nodes = (3, 1.0)
   }

    segment = {
        length = 23
        material = nilspin_3/8in
        nodes = (46, 1.0)
        }


     connector = pivot2

   segment = {
      length = 1.9
      material = sensor_cage
      nodes = (3, 1.0)
   }

   connector = pivot2



#ifdef CONFIG1
        segment = {
        length = 1.5
        material = ESP_Assembly_ForCatenary
        nodes = (4, 1.0)
        }

        segment = {
        length = 10
        material = Stretch_Hose
        nodes = (40, 1.0)
        }
#endif

#ifdef CONFIG4
        segment = {
        length = 1.5
        material = ESP_Assembly_ForTaut
        nodes = (4, 1.0)
        }

        segment = {
        length = 10
        material = Stretch_Hose
        nodes = (40, 1.0)
        }
#endif


#ifdef CONFIG2
        segment = {
        length = 1.5
        material = ESP_Assembly_ForCatenary
        nodes = (4, 1.0)
        }
```

```
        segment = {
        length = 15
        material = EM_Chain
        nodes = (30, 1.0)
        }

#endif

#ifdef CONFIG3
        segment = {
        length = 1.5
        material = ESP_Assembly_ForTaut
        nodes = (4, 1.0)
        }

        segment = {
        length = 8
        material = Stretch_Hose
        nodes = (32, 1.0)
        }
#endif



   terminal = {
      buoy = cce2_2_buoy
   }

End
```