

Planning Your Mission to Mars, the Red Planet

[Part 5]

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[Note]

This was independently written to work with the Mars Simulation unit available from Interact, 5937 Darwin Court, Suite 106, Carlsbad, CA 92008.

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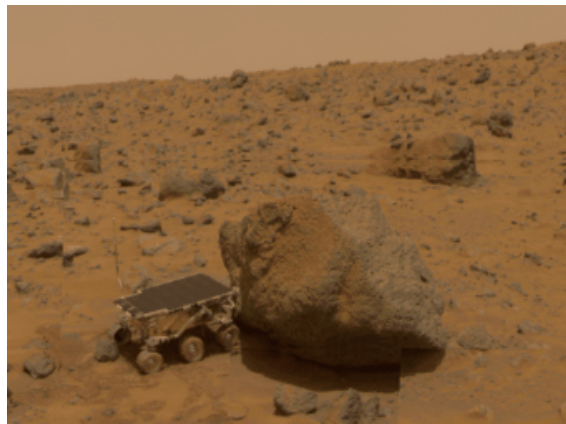
**Mars Mission Science Camp
School District 203, Naperville, IL**

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Summary

This is the fifth of five sessions in which you will use the computer programming language "perl" to:

plan your mission to Mars, the red planet.



<http://www.jpl.nasa.gov/files/images/browse/81958b.gif>

1.0 Schedule - Where Are We in Our Mars Simulation?

The following table shows what we have accomplished (x) and what we are about to do (>):

<u>Day</u>	<u>• Computer Session</u>	<u>• Class Session</u>
Monday:	x Learn Basics of Perl	x Human Factors: Food, Water, Oxygen
Tuesday:	x Add human factors to simulation x Run the simulation.	x Perils of the Journey: Microgravity versus x Artificial Gravity. Exercise. Solar Flares.
Wednesday:	x Add perils to simulation. x Run the simulation.	x Life on Mars. Where to land. Wind, Water, x CO ₂ , hard/soft, high/low,
Thursday:	> Add landing site to simulation	— Trajectory: Direct vs Slingshot around Venus
Friday:	— Add trajectory to simulation — Run the simulation.	

Yesterday, you considered the possibilities of life on Mars. That was the specific topic but the general topic is "how can we maximize the rewards from our mission to Mars?"

Some ways our mission plans can maximize the rewards are by:

- (a) maximizing the length of time we are on the surface of the planet,
- (b) going to sites that seem likely to harbor present life (water, carbon, etc.)
- (c) going to sites that seem likely to have evidence of past life (riverbeds, rocky areas, etc.

After selecting a site, a certain amount of random fate dictates the consequences that follow from that selection. What matters most is how well-prepared and well-trained the mission team is. A simulation here does not attempt to predict the unpredictable but instead tries to suggest where best to spend one's training and contingency dollars.

On a more specific note, the research information suggestions that we should:

- (a) prefer sites with low winds or medium winds—not high winds,
- (b) prefer sites of medium firmness—not soft or hard,
- (c) prefer plains and possibly canyons to mountains
- (d) examine sites with water, with CO₂, with both, or with neither

Finally, some specific spots are suggested:

- (a) rim of a polar ice cap,
- (b) volcanic regions,
- (c) Area: Longitude 250° Latitude 55° N.
- (d) Area: Longitude 103° Latitude 8° N in the Tharsis region
- (e) Area: Longitude 345° Latitude 50° N in the Cydonia region
- (f) Volcano Olympus Mons
- (g) Mariner Valley

I have put a landing site selection option into the simulation and extended the Simulation Story and Dictionary. The new items are underlined.

2.0 Your Goals for Yesterday and Today

Yesterday, I gave you your goals and asked you to decide some for today. In the space below, list three goals you have for yourself and your team for today. **Tomorrow, I will ask you to write down whether or not you accomplished the goals you listed.**

2.1 Goal Number 1

2.2 Goal Number 2

2.3 Goal Number 3

3.0 The Simulation Story

We need a simulation story to guide us. The story describes the facts we are going to take into account in our simulation and how we are going to do it. So far: Human Factors, MicroGravity Disabilities, and now Landing Site Selection

3.1 The Human Factors and Perils Chapter

The mission lasts for 31 months. We will treat months as having 30 days each. A mission has a "sponsoring country" whose name can be specified.

There are four to six crew members with the numbers of men and women to be specified as input into the simulation. There can be one or two scientists and one or two military officers. The second scientist or military officer is on the mission provided he or she has been given a name.

The daily food, drinking water, and oxygen requirements for each woman crew member are 2.55 lbs, 4.25 lbs, and 1.70 lbs, respectively. The daily food, drinking water, and oxygen requirements for each man crew member are 3 lbs, 5 lbs, and 2 lbs, respectively.

We begin with a total amount of food, drinking water, and oxygen. Each day we reduce the total amount of food, drinking water, and oxygen. If we are recycling everything, there is nothing more to say.

Each person now has a health factor. The health factor starts at 100.

Each person also has a daily exercise counter. If this is set to 1, the person exercises every day. If set to 2, every second day, etc. Each day the person exercises 0.1 is **added** to their health factor. Each day the person exercises the daily food, water, and oxygen usage is multiplied by 1.05—increasing the daily food, water and oxygen consumption per exercising person by 5%.

The mission now has a gravity indicator. This indicator is "true" if the ships containing the human beings have artificial gravity. Otherwise, it is false meaning that there is **no** gravity. If there is no gravity, then 0.075 is **subtracted** from the person's health factor each day so that exercise wins a bit over the lack of gravity.

3.2 The Site Selection Chapter

The mission team can indicate its site preferences in four different categories: wind, firmness, terrain, and composition.

Category	Pref A	Pref B	Pref C	Pref D
Wind	<u>Low</u>	Med	<u>High</u>	
Firmness	<u>Soft</u>	<u>Med</u>	<u>Hard</u>	
Terrain	<u>Canyons</u>	<u>Plains</u>	<u>Mountains</u>	
Composition	<u>Water</u>	<u>CO2</u>	Water & CO2	Neither

Still, a certain randomness may occur and the mission team should expect that they may not get a site with the characteristics they want. The consequences which may occur with a certain probability are as follows:

1. High winds on a soft mountain site may result in the lander tipping over so that extensive repairs are required. This delays your departure, resulting in your missing your launch window and having to stay on Mars another five months (150 days). Mission payback is decreased by 50%. You'd better hope you have enough food, water, and oxygen to make it.
2. Water and/or CO2 in a soft canyon site may result in the discovery of primitive life forms. This increases the mission payback by 10%.
3. Low winds on soft or medium plains almost always results in a successful landing with no ill effects. However, mission payback is generally very little.
4. Hard mountain sites are generally not good though mission payback may be higher because of fossil discoveries.
5. Medium wind on areas having neither water nor CO2 are alright as successful landing sites but mission payback is low.

The team can choose one of the specific spots with certainty. The specific spot will hopefully have the preferred characteristics requested by the team.

The landing period will commence 8 months (240 days) after the start of the mission. It will last between 20 and 40 days. Each day there is a random chance of discovery. Discovering fossils increases mission payback by 10%. Discovering primitive life forms doubles the mission payback. Gravity is switched on while the team is on Mars. Afterwards, it is put back to whatever it was before the landing.

4.0 The Simulation Dictionary

This is a list of the variables in the simulation and what they specify.

4.1 Mission Parameters

\$Mi sMonths.	The length of the mission in months.
\$Mi sDays.	The length of the mission in days.
\$Day.	The particular day of the mission.
\$Mi sCountry.	The name of the country sponsoring the mission
\$Mi sGravi ty.	The mission gravity indicator. If true, the mission has artificial gravity. Otherwise, it has no gravity.
\$Mi sLandDay.	The day of the landing
\$Mi sMarsDur.	The number of days of the stay on Mars. This is a number between 1 and 40.
\$Mi sPayback.	The payback for a successful mission. It is initially set at 1000 and is increased or decreased according to circumstances.

4.2 People

\$Sci Name.	The name of the Scientist
\$Sci MM.	="M" if scientist is a man; = "W" if scientist is a woman
\$Sci H.	The health of the scientist beginning at 100 and increasing or decreasing as situations occur.
\$Sci EF.	The exercise frequency of the scientist: 1 => the person exercises every day, 2 => every other day, etc.
\$Sci 2Name.	The name of the second scientist. If name is "", then the scientist is not on the mission.
\$Sci 2MM.	="M" if second scientist is a man; = "W" if second scientist is a woman
\$Sci 2H.	The health of the second scientist beginning at 100 and increasing or decreasing as situations occur.
\$Sci 2EF.	The exercise frequency of the second scientist: 1 => the person exercises every day, 2 => every other day, etc.
\$MedName.	The name of the Medical Officer
\$MedMM.	="M" if Medical Officer is a man; = "W" if Medical Officer is a woman
\$MedH.	The health of the scientist beginning at 100 and

	increasing or decreasing as situations occur.
\$MedEF.	The exercise frequency of the Medical Officer: 1 => the person exercises every day, 2 => every other day, etc.
\$Mi l Name.	The name of the Military Officer
\$Mi l MW.	= "M" if Military Officer is a man; = "W" if Military Officer is a woman
\$Mi l H.	The health of the Military Officer beginning at 100 and increasing or decreasing as situations occur.
\$Mi l EF.	The exercise frequency of the Military Officer: 1 => the person exercises every day, 2 => every other day, etc.
\$Mi l 2Name.	The name of the second Military Officer
\$Mi l 2MW.	= "M" if second Military Officer is a man; = "W" if second Military Officer is a woman
\$Mi l 2H.	The health of the second Military Officer beginning at 100 and increasing or decreasing as situations occur.
\$Mi l 2EF.	The exercise frequency of the second Military Officer: 1 => the person exercises every day, 2 => every other day, etc.
\$Mi sName.	The name of the Mission Commander
\$Mi sMW.	= "M" if Mission Commander is a man; = "W" if Mission Commander is a woman
\$Mi sH.	The health of the scientist beginning at 100 and increasing or decreasing as situations occur.
\$Mi sEF.	The exercise frequency of the Mission Commander: 1 => the person exercises every day, 2 => every other day, etc.

4.3 Human Factors

\$Total Food.	The total food on the mission
\$Total Water.	The total water on the mission
\$Total Oxygen.	The total oxygen on the mission
\$Dai l yFoodW.	The daily food consumed by the average woman
\$Dai l yFoodM	The daily food consumed by the average man
\$Dai l yWaterW.	The daily water consumed by the average woman
\$Dai l yWaterM	The daily water consumed by the average man

\$DailyOxygenW. The daily oxygen consumed by the average woman

\$DailyOxygenM. The daily oxygen consumed by the average man

4.4 Site Factors

\$Site. Variable which holds the specific site chosen:

0 = Anywhere

1 = Rim of Polar Ice Cap

2 = Volcanic Region

3 = Area: Long 250° Lat 55° N.

4 = Area: Long 103° Lat 8° N - Tharsis region

5 = Area: Long 345° Lat 50° N - Cydonia region

6 = Volcano Olympus Mons

7 = Mariner Valley

\$Wind. Wind preference: 0, 1, or 2 for low, med., or high

\$Firm. Firmness preference: 0, 1, or 2 for soft, med., or hard

\$Terr. Terrain preference: 0, 1, or 2 for Canyons, Plains, or Mountains

\$Comp. Composition preference: 0, 1, 2, 3 for neither, water, CO₂, or both.

5.0 Human Factors, Perils and Site Simulation

```
#   Example p5s50e1.pl
#   People
    $SciName = "Mary Smith";
    $SciMW   = "W";
    $SciH    = 100;
    $SciEF   = 1;
    $Sci2Name = "Jeff Slattery";
    $Sci2MW  = "M";
    $Sci2H   = 100;
    $Sci2EF  = 1;
    $MedName = "James Roberts";
    $MedMW   = "M";
    $MedH    = 100;
    $MedEF   = 1;
    $MilName = "Susan Limon";
    $MilMW   = "W";
    $MilH    = 100;
    $MilEF   = 1;
    $Mil2Name = "Reggie DeBates";
    $Mil2MW  = "M";
    $Mil2H   = 100;
    $Mil2EF  = 5;
    $MilsName = "Kenneth Bates";
    $MilsMW  = "M";
    $MilsH   = 100;
    $MilsEF  = 1;

#
#   Resources - must increase these -- just examples
    $TotalFood   = 400000.0;
    $TotalWater  = 400000.0;
    $TotalOxygen = 400000.0;

#
#   say how much a woman crew member needs each day
    $DailyFoodW   = 2.55;
    $DailyWaterW  = 4.25;
    $DailyOxygenW = 1.70;

#
```

```

# say how much a man crew member needs each day
$DailyFoodM = 3.00;
$DailyWaterM = 5.00;
$DailyOxygenM = 2.00;

#
# Sponsoring Country
$MisCountry = "Brazil";
$MisPayback = 1000;
$MisLandDay = 240;
$MisMarsDur = 20;
$Site = 1;

#
# some places to hold current exercise counts
$SciEFc = $SciEF;
$Sci2EFc = $Sci2EF;
$MedEFc = $MedEF;
$MilEFc = $MilEF;
$Mil2EFc = $Mil2EF;
$MisEFc = $MisEF;

#
# an array with the name of the possible sites
@SiteNames = ('Anywhere',
              'Rim of Polar Ice Cap',
              'Volcanic Region',
              'Area: Long 250° Lat 55° N.',
              'Area: Long 103° Lat 8° N - Tharsis',
              'Area: Long 345° Lat 50° N - Cydonia',
              'Volcano Olympus Mons',
              'Mariner Valley');
@WindNames = ('low', 'medium', 'high');
@FirmNames = ('soft', 'medium', 'hard');
@TerrNames = ('Canyons', 'Plains', 'Mountains');
@CompNames = ('Sand', 'Water', 'Frozen CO2',
              'Water and Frozen CO2');

```

```

#-----
#   Beginning the Human Factors Simulation
print ("Beginning Human Factors Simulation\n");
print ("----Mission for $Mi sCountry----\n");
print ("Mission Commander $Mi sName\n");
print ("Scientist          $Sci Name\n");
print ("Scientist          $Sci 2Name\n") if ($Sci 2Name);
print ("Military Officer  $Mi lName\n");
print ("Military Officer  $Mi l2Name\n") if ($Mi l2Name);
print ("Medical Officer   $MedName\n");

#
#   The number of months in the mission and days
#   assuming 30 days per month and our gravity flag
$Mi sMonths = 31;
$Mi sDays   = $Mi sMonths * 30;
$Mi sGravity = 0;

#-----
#   for each day of the mission
#   pretend to exercise, deal with gravity
#   eat, drink, breathe and do Mars things
foreach $Day (1.. $Mi sDays) {
    Exercise();
    HandleGravity();
    EatFood();
    DrinkWater();
    BreatheOxygen();

#
#   if it is landing day...
if ($Day == $Mi sLandDay) {
    PickSite();
    print ("Day: $Day. Landing on Mars...\n");
    print ("          Site is $SiteNames[$Site]\n");
    print ("Wind is $WindNames[$Real Wind]\n",
          "Firmness is $FirmNames[$Real Firm]\n",
          "Terrain is $TerrNames[$Real Terr]\n",
          "Composition is $CompNames[$Real Comp]\n");

#
#   save gravity flag and set gravity on while on mars
$Mi sGravitySave = $Mi sGravity;

```

```

        $Mi sGravity = 1;
    }
#
#   if it is a day on Mars
    if ( ($Day > $Mi sLandDay) and
        ($Day < $Mi sLandDay + $Mi sMarsDur) ) {
        DoMarsDay();
    }
#
#   if it is take off day
    if ( $Day == $Mi sLandDay + $Mi sMarsDur) {
        print ("Day: $Day. Taking off from Mars...\n");
    }
#
#   restore gravity flag
        $Mi sGravity = $Mi sGravitySave;
    }
#
#       print the day every 30 days to show we're working
    if ($Day%30 == 0) { print ("Day: $Day\n"); }
}

```

```

#
# print status at the end of mission
# resources left
printf ("-----Status At End of Mission-----\n");
printf ("          Time: %18.1f (days)\n", $Mi sDays);
printf ("  Food Left: %18.1f\n Water Left: %18.1f\n  Oxy
Left: %18.1f\n",
        $TotalFood, $TotalWater, $TotalOxygen);
#
# print status of people
printf ("Scientist:  %18.18s Health: %18.1f\n",
        $SciName, $SciH);
printf ("Scientist:  %18.18s Health: %18.1f\n",
        $Sci2Name, $Sci2H) if ($Sci2Name);
printf ("Med. Off.:  %18.18s Health: %18.1f\n",
        $MedName, $MedH);
printf ("Mil. Off.:  %18.18s Health: %18.1f\n",
        $MilName, $MilH);
printf ("Mil. Off.:  %18.18s Health: %18.1f\n",
        $Mil2Name, $Mil2H) if ($Mil2Name);
printf ("Mi s. Cmd.: %18.18s Health: %18.1f\n",
        $Mi sName, $Mi sH);
exit;

```

```

##### Beginning of all our subroutines#####
sub PickSite {
    if ($Site == 0) {
        $Site = rand(6.0) + 1.0;
    }
    # get four random numbers to help pick
    $PickWind = rand(10.0);
    $PickFirm = rand(10.0);
    $PickTerr = rand(10.0);
    $PickComp = rand(10.0);
    #
    # Now pick team's preference 70 percent of the time
    if ($PickWind > 3.0) {
        $RealWind = $Wind ;
    } else {
        $RealWind = rand(3)%3;
    }
    if ($PickFirm > 3.0) {
        $RealFirm = $Firm ;
    } else {
        $RealFirm = rand(3)%3;
    }
    if ($PickTerr > 3.0) {
        $RealTerr = $Terr ;
    } else {
        $RealTerr = rand(3)%3;
    }
    if ($PickComp > 3.0) {
        $RealComp = $Comp ;
    } else {
        $RealComp = rand(4)%4;
    }
    return;
}
sub DoMarsDay {
    if ($RealWind == 2 && $RealFirm == 0 && $RealTerr == 2 )
    {
        print ("Day: $Day. Your lander tipped over.\n",
              "          Plan on another 5 months!\n");
    }
}

```

```

    $Mi sMonths += 5;
    $Mi sDays = $Mi sMonths * 30;
    $Mi sPayback = $Mi sPayback * 0.5;
}
if ($Real Firm == 0 && $Real Terr == 0 ) {
    if ( !($Real Comp == 3) ) {
        $Mi sPayback = 1.1 * $Mi sPayback;
        print ("You've landed in a soft canyon site",
            " with water and/or CO2!\n",
            " Payback increased to $Mi sPayback.\n");
    }
}
return;
}
sub HandleGravity {
#
# if no gravity then adjust health down
if ($Mi sGravity == 0) {
    $Sci H = $Sci H - 0.075;
    $Sci 2H = $Sci 2H - 0.075 if ($Sci 2Name ne "");
    $MedH = $MedH - 0.075;
    $Mi lH = $Mi lH - 0.075;
    $Mi l2H = $Mi l2H - 0.075 if ($Mi l2Name ne "");
    $Mi sH = $Mi sH - 0.075;
}
return;
}
}

```

```

sub Exercise {
#
# Scientist: Count down exercise frequency
# when get to 0, add 0.1 to health and reset exer freq cnt
$SciEFc = $SciEFc - 1;
$SciH = $SciH + 0.1 if ($SciEFc == 0);
$SciEFc = $SciEF if ($SciEFc == 0);
# Second Scientist
if ($Sci2Name ne "") {
    $Sci2EFc = $Sci2EFc - 1;
    $Sci2H = $Sci2H + 0.1 if ($Sci2EFc == 0);
    $Sci2EFc = $Sci2EF if ($Sci2EFc == 0);
}
# Medical Officer
$MedEFc = $MedEFc - 1;
$MedH = $MedH + 0.1 if ($MedEFc == 0);
$MedEFc = $MedEF if ($MedEFc == 0);
# Military Officer
$MilEFc = $MilEFc - 1;
$MilH = $MilH + 0.1 if ($MilEFc == 0);
$MilEFc = $MilEF if ($MilEFc == 0);
# Second Military Officer
if ($Mil2Name ne "") {
    $Mil2EFc = $Mil2EFc - 1;
    $Mil2H = $Mil2H + 0.1 if ($Mil2EFc == 0);
    $Mil2EFc = $Mil2EF if ($Mil2EFc == 0);
}
# Mission Commander
$MisEFc = $MisEFc - 1;
$MisH = $MisH + 0.1 if ($MisEFc == 0);
$MisEFc = $MisEF if ($MisEFc == 0);
return;
}

```

```

sub EatFood {
#
# Initialize Daily Food Usage
$DailyFood = 0.0;
#
# Assume Scientist is just regularly hungry
# and then see if Scientist just finished exercising
# and increase hunger accordingly
$Hungry = 1.00;
if ($SciEF eq $SciEFc) {$Hungry = 1.05;}
if ($SciMW eq "M") { $DailyFood += $DailyFoodM*$Hungry;}
else { $DailyFood += $DailyFoodW*$Hungry;}
if (!$Sci2Name) {
$Hungry = 1.00;
if ($Sci2EF eq $Sci2EFc) {$Hungry = 1.05;}
    if ($Sci2MW eq "M") {$DailyFood +=
        $DailyFoodM*$Hungry;}
    else { $DailyFood +=
        $DailyFoodW*$Hungry;}
}
$Hungry = 1.00;
if ($MedEF eq $MedEFc) {$Hungry = 1.05;}
if ($MedMW eq "M") {$DailyFood += $DailyFoodM*$Hungry;}
else { $DailyFood += $DailyFoodW*$Hungry;}
$Hungry = 1.00;
if ($MilEF eq $MilEFc) {$Hungry = 1.05;}
if ($MilMW eq "M") {$DailyFood += $DailyFoodM*$Hungry;}
else { $DailyFood += $DailyFoodW*$Hungry;}
if (!$Mil2Name) {
    $Hungry = 1.00;
    if ($Mil2EF eq $Mil2EFc) {$Hungry = 1.05;}
    if ($Mil2MW eq "M") {$DailyFood +=
        $DailyFoodM*$Hungry;}
    else { $DailyFood +=
        $DailyFoodW*$Hungry;}
}
$Hungry = 1.00;
if ($MisEF eq $MisEFc) {$Hungry = 1.05;}
if ($MisMW eq "M") {$DailyFood += $DailyFoodM*$Hungry;}
}

```

```
else                {$DailyFood += $DailyFood*$Hungry;}
$TotalFood = $TotalFood - $DailyFood;
if ($TotalFood <= 0 ) {
    print ("Day $Day:  No food left!\a\n");
    exit;
}
return;
}
```

```

# Subroutine DrinkWater
sub DrinkWater {
#
# Get total daily water according to man or woman
$DailyWater = 0.0;
$Thirsty = 1.00;
if ($SciEF eq $SciEFc) {$Thirsty = 1.05;}
if ($SciMW eq "M") { $DailyWater +=
                    $DailyWaterM*$Thirsty;}
else                { $DailyWater +=
                    $DailyWaterW*$Thirsty;}

if (!$Sci2Name) {
    $Thirsty = 1.00;
    if ($Sci2EF eq $Sci2EFc) {$Thirsty = 1.05;}
    if ($Sci2MW eq "M") {$DailyWater +=
                        $DailyWaterM*$Thirsty;}
    else                { $DailyWater +=
                        $DailyWaterW*$Thirsty;}
}
$Thirsty = 1.00;
if ($MedEF eq $MedEFc) {$Thirsty = 1.05;}
if ($MedMW eq "M") {$DailyWater +=
                    $DailyWaterM*$Thirsty;}
else                { $DailyWater +=
                    $DailyWaterW*$Thirsty;}

$Thirsty = 1.00;
if ($MilEF eq $MilEFc) {$Thirsty = 1.05;}
if ($MilMW eq "M") {$DailyWater +=
                    $DailyWaterM*$Thirsty;}
else                { $DailyWater +=
                    $DailyWaterW*$Thirsty;}

if (!$Mil2Name) {
    $Thirsty = 1.00;
    if ($Mil2EF eq $Mil2EFc) {$Thirsty = 1.05;}
    if ($Mil2MW eq "M") {$DailyWater +=
                        $DailyWaterM*$Thirsty;}
    else                { $DailyWater +=
                        $DailyWaterW*$Thirsty;}
}
}

```

```

$Thirsty = 1.00;
if ($MiseF eq $MiseFc) {$Thirsty = 1.05;}
if ($MismW eq "M") {$DailyWater +=
                    $DailyWaterM*$Thirsty;}
else                {$DailyWater +=
                    $DailyWaterW*$Thirsty;}
$TotalWater = $TotalWater - $DailyWater;
#
# if we have drunk all the water, print out day and exit
if ($TotalWater <= 0 ) {
    print ("Day $Day:  No water left!\a\n");
    exit;
}
return;
}

```

```

# Subroutine BreatheOxygen
sub BreatheOxygen {
#
# Get total daily oxygen according to man or woman
$DailyOxygen = 0.0;
$Huff = 1.00;
if ($SciEF eq $SciEFc) {$Huff = 1.05;}
if ($SciMW eq "M") { $DailyOxygen +=
                    $DailyOxygenM*$Huff;}
else                { $DailyOxygen +=
                    $DailyOxygenW*$Huff;}

if (!$Sci2Name) {
    $Huff = 1.00;
    if ($Sci2EF eq $Sci2EFc) {$Huff = 1.05;}
    if ($Sci2MW eq "M") {$DailyOxygen +=
                        $DailyOxygenM*$Huff;}
    else                {$DailyOxygen +=
                        $DailyOxygenW*$Huff;}
}
$Huff = 1.00;
if ($MedEF eq $MedEFc) {$Huff = 1.05;}
if ($MedMW eq "M") {$DailyOxygen +=
                    $DailyOxygenM*$Huff;}
else                {$DailyOxygen +=
                    $DailyOxygenW*$Huff;}

$Huff = 1.00;
if ($MilEF eq $MilEFc) {$Huff = 1.05;}
if ($MilMW eq "M") {$DailyOxygen +=
                    $DailyOxygenM*$Huff;}
else                {$DailyOxygen +=
                    $DailyOxygenW*$Huff;}

if (!$Mil2Name) {
    $Huff = 1.00;
    if ($Mil2EF eq $Mil2EFc) {$Huff = 1.05;}
    if ($Mil2MW eq "M") {$DailyOxygen +=
                        $DailyOxygenM*$Huff;}
    else                {$DailyOxygen +=
                        $DailyOxygenW*$Huff;}
}
}

```

```

$Huff = 1.00;
if ($MisEF eq $MisEFc) {$Huff = 1.05;}
if ($MisMW eq "M") {$DailyOxygen +=
                    $DailyOxygenM*$Huff;}
else                {$DailyOxygen +=
                    $DailyOxygenW*$Huff;}
$TotalOxygen = $TotalOxygen - $DailyOxygen;
#
# if we have breathed the oxygen, print out day and exit
if ($TotalOxygen <= 0 ) {
    print ("Day $Day:  No oxygen left!\a\n");
    exit;
}
return;
}

```