Harpoon Form Instructions v1.1 27JUL2020

General

The Harpoon editable .pdf forms are designed to aid you in organizing the information needed to play *Harpoon* without having to constantly refer back to the Annexes and rulebooks during play. While they take some time to set up, once they are completed, they can be saved and reused as needed.

Local Use

Many browsers do not allow you to fill out editable .pdfs directly. Instead, you must download the form to your own computer and modify it there. Usually there is a "download" option on the browser .pdf display, or you can right-click on the link and use the "save as" or "save link as". Once you have saved the form locally, the ubiquitous Adobe Acrobat Reader should work fine. Also, make sure that your security software does not disable scripts, or the forms will not work correctly.

Prefilled Examples

To demonstrate the use of the forms, we have filled them with examples from the various Harpoon Annexes. Just overwrite this information with what you need for your games.

Calculations

Most of the fields on the form are "information only." However, entering data in some fields will cause other information to be calculated and filled according to the Harpoon V rules, so you don't need to remember all of the details. For example, if you enter the size class and speed of a ship and check the boxes if special conditions apply, the form will then calculate the turn and acceleration information, based on the table on page 3-2 of the rules. The calculations done on each form are described in the sections on that form.

Using Tab to traverse the form - committing the changes

While entering information that is used in calculations, it will occasionally seem that what you enter does not have an immediate effect. Sometimes this happens because the form does not register the changed data (called "committing the change"). It will not invoke any associated code unless you move to another field after you have finished entering the information (called "changing focus"). The easiest way to ensure that you change focus and your information is "committed" to use the "tab" key to move to the next field. Selecting a different field with the mouse will also work. This is especially important in the Air Mission Planning Form.

Active Sonar Frequency Bands - Superscript Styling

Sonar Frequencies bands in Harpoon V are important because environmental conditions often have different effects on different frequencies. If a frequency is used for active sonar, it is denoted by a superscript "a" in Annex K. For example, an active High Frequency Sonar is denoted "HF^{a}". Multiple-frequency sonars will only use active sonar

in one of their bands. For example, a sonar which listed as LMF^{a}-MF in Annex K will use active sonar in the LMF band but listen passively in both the LMF and MF bands. If you wish, the forms allow you to follow this convention by allowing you to “style” the frequency bands. First, enter the entire text of the frequency (“LMFa-MF”, for example). Then use your mouse to select the “a” and right-click. This will bring up a menu. One of the options is “text style”. Select “superscript” and it will change the entry to “LMF^{a}-MF.” This may be hard to read when you print the form because of the size of the text, so you may want to ignore the styling and just use the straight text “LMFa-MF”.

Remarks

It is almost impossible to anticipate every possible piece of relevant information or special condition, so remarks fields are provided. If something doesn’t fit neatly into the categories we provided, put it into the remarks field.

Harpoon V Form 1 (Surface)

Form 1 (Surface) is designed for modern surface ships. There is a companion form for submarines.

Unlike earlier historical periods, where the only weapons were guns and torpedoes, and radar and sonar were in their infancy, modern ships have many types of weapons, sensors, and miscellaneous equipment. Form 1 (Surface) organizes this into two pages. The first page is primarily information about the ship, its sensors, and weapons mounts. The second page contains information about the weapons themselves.

Calculations

Damage Points + Speed ->Damage Levels + Speed Loss

Size Class -> Size Description

Size Class + Speed + Maneuvering Checkboxes ->Turn and Acceleration

Combat System->Gunnery Standard

Form Description and Comments

The top part of the form comes directly from Annex A for a ship class. Ships often undergo refits, so the “Config. Date” is important, and be sure to check the Remarks section for changes in equipment. Also, the “In Service Date” is used according to section 14.4 of the rules when calculating Fire & Flooding damage.

You only need to enter the 100% damage points and undamaged speed. The form will calculate the other damage breakpoints.

Whether the Maneuvering checkboxes apply can be found in Annex A and the Remarks section for the individual ship. Perhaps the most common is “Controllable Pitch Propellors” (CPP), which is usually found in the propulsion data of Annex A. “Restricted Turn” indicates that the ship will turn as if it were one size class larger than its actual size,

”Single Prop” increases the speed reduction effect of engineering hits and a checkbox for this is provided (for information only).

The next section of the form involves combat system and special sensors and countermeasures. These are entered from Annex A. Note that the Gunnery Standard (GS) determined from the type of Combat System (see section 8.3 of the rules) and is automatically populated when you choose the combat system.

The next sections of the form involve the radars, sonars, and weapon mounts. From Annex A, get the names of the systems and then get the specifics from the various annexes. Each mount and sensor in this section has a free-form remarks field where extra information can be entered.

The second page has information about the weapons carried by the ship. Sections are provided for Missiles, Torpedoes, Guns, ASW, and Depth Charges, with the fields for the essential data of each type. Once again, use the remarks field to put in special information. Finally, both the first and second pages have remarks sections for any extra information you want to add.

Harpoon V Form 1 (Submarine)

While a modern submarine's information is similar to surface ship's, there is a greater emphasis on sonar than radar, and certain information is not needed (guns and anti-air missiles, for example). Also, some information is applicable only to submarines. Unlike the surface form, we were able to put all of the information relevant to submarines on one page.

Calculations

Damage Points + Speed ->Damage Levels + Speed Loss (for both surface and submerged)

Size Class -> Size Description

Size Class + Speed + Maneuvering Checkboxes ->Turn and Acceleration (for both surface and submerged)

Combat System -> Number of targets and WG torps

Form Description and Comments

The top part of the form comes directly from Annex A for a sub class. Subs often undergo refits, so the "Config. Date" is important; be sure to check the Remarks section for changes in equipment. Also, the "In Service Date" is used according to section 14.4 of the rules when calculating Fire & Flooding damage.

You only need to enter the 100% damage points and undamaged speeds for surface and submerged. The form will calculate the other damage breakpoints.

There are various special features (anechoic coating, titanium hull, and double hull) that can be set as checkboxes. This is followed by depth, propulsion type, and battery information along with a checkbox for Air Independent Propulsion (AIP).

The next section of the form involves the combat system and special sensors and countermeasures. These are entered from Annex A. Note that the combat system

determines the maximum number of targets that can be tracked and the number of wire guided torpedoes that can be controlled (Rules section 6.4). While you can change the number of wire guided torpedoes (see section 6.4 to see why you would want to), if you select the Combat System again, it will reset this field.

The next sections of the form cover the radars, sonars, and weapon mounts. From Annex A, get the types of the systems and then get the specifics from the various annexes. Each mount and sensor in this section has a free-form remarks field where extra information can be entered.

The bottom of the form has information about the weapons carried by the sub. The only types listed here are torpedoes and missiles (land attack/anti-ship/and ASW standoff). If a sub carries mines or has an anti-air capability (some carry MANPAD missiles that can be fired from the surface or periscope depth), list these in the remarks.

Air Mission Form (Harpoon V Form 2)

This form assists you in planning your Harpoon V air missions, by setting up the information for a single aircraft type. The information comes primarily from Annex B of the air supplements and annexes. Note that this called an Air “Mission” form rather than an Air “Data” form because the configuration of the external stores and ordnance of an aircraft can change based on what its role is for that mission, Examples include Strike or Combat Air Patrol.

Calculations

Ceiling + Engine Type -> Available Throttle Speed Settings. You will only be able to enter throttle speeds for altitudes that the aircraft can reach.

Weight(s) -> Load. The Load of the aircraft is calculated by adding up the weight of additional fuel, external pods, weapons, etc. As you add more ordnance, the load will go up and the Load % will be increased. Note that for most weapons, the weight is the number of weapons x the weight of a single weapon. No edits are done to see if the total weight exceeds the maximum load, so be sure to check that your plane can get off the ground.

Maximum Load + Load -> Load %-> Mod Range. If Load % >=80 then the range is decreased.

Internal Crs (Cruise) Rng + Additional Fuel Range -> Mod Range. The modified range is first calculated by adding the internal fuel and additional fuel (from drop tanks, conformal packs, etc.). Range is measured in nautical miles (nmi)

Form Description and Comments

With the exception of the fields used in calculations most of the data is free form entry, the best way to see how the form works is to follow through the example that we used in the form, a “P3C Orion Update I” on a Patrol mission. For your own aircraft, just overwrite this information with the plane and configuration you are using,

The top of the form is mostly copied directly from Annex B.
Mission/Mission ID - You can choose from a variety of missions, and the Mission ID is an optional field that allows you to identify the specific mission.

From Annex B, we find that the Orion has a Turbo-prop engine (TP) and a Ceiling of 8625 meters. Entering these two values has several effects:
a) A TP engine has no afterburner setting, so the afterburner speeds disappear.
b) A ceiling of 8625 meters is in the High altitude band, so the Very High speeds disappear.

Various altitude bands can be found in the "Altitude Bands" table in chapter 4 of the Harpoon V rules, but these are incorporated into the form calculations, so you don’t

need to know them. For fuel calculations, aircraft and missiles in NOE and Very Low (VLow) flight are contained in the Low band and the "Real High" band is not used , except by missiles.

Cruise Range and Additional Range
Cruise Range comes directly from Annex B. In the case of the Orion, it is 4105 nmi. Other planes may have additional fuel sources that are added to the cruise range to give the modified range “Mod. Rng”. The Orion has no drop tanks or additional sources of fuel, so its modified range starts out as 4105 nmi.

The Orion has no guns, so the gun rating and type are blank

The Orion has an APS-115 radar so the stats for this radar are entered in this section.

Next comes a line that can best be called “Miscellaneous Sensors”. The Annex B entry shows that the Orion has a Low Light TV (LLTV) and Magnetic Anomaly Detector (MAD) so these checkboxes are set. Later updates of the Orion have a FLIR, but not the one we are using.

Next come sonars. One of the primary functions of the Orion is ASW, but the Orion has no built-in sonar and uses sonobuoys instead. Annex B says that it carries 84 sonobouys and also gives a typical load of 3 of the available types from Annex K2 which are entered here.

The next section is the acoustic processor. Annex B lists an AQA-7(V) 1 processor, so its stats are entered.

Up to this point we have been dealing with the standard configuration of the Orion, but now we look at the equipment specific to its Patrol mission. Annex B lists nine(!) different loadouts for the Orion, but we need to choose only one. In this case, we are doing a “Patrol” mission, so the most relevant seems to be the “Patrol & Escort” mission (the 5th one in the list) of 4 x Mk46 torpedoes, 4 x Harpoon missiles, and 1 ALQ-76 ES electronics pod. The data for these is entered in the appropriate section. Note that each of these has a “Hang Weight” associated with it. The total hang weight is recalculated as new ordnance is added. This is added to the weight of any additional fuel to give the “Load” and “Load %”. Adding together the weight of 4 Harpoons (526 kg each), 4 Mk46 torpedoes (292 kg each), and the electronics pod (500 kg) gives us a total weight of 3772 kg, which shows up in the Load field. If the weight exceeds 80% of the maximum load, the Modified Range is decreased. Standard equipment (such as the radar and sonar processor) and weight of the internal fuel of the Orion is not counted in this total load.

Our Orion is now set up to go on patrol. This form is used along with the Air Mission Planning Form (Form 5) that helps calculate fuel usage.

Air Mission Planning Form (Harpoon V Form 5)

This form is used to calculate fuel usage for Air Missions. You can enter mission profiles for two aircraft types on one page. It implements the rules in section 4.7 (Aircraft Endurance) of Harpoon V.

Calculations

With a few exceptions almost every field on this form is involved in a calculation in some way, as it uses speed, throttle settings, and altitude to calculate fuel use. Please remember the advice about tabbing through the form in the introduction, to make sure that your changes take effect before you move on to the next field.

Using Tab to traverse the form - committing the changes

While entering information that is used in calculations, it will occasionally seem that what you entered does not have an immediate effect. This is especially noticeable in the Air Mission Planning form, because it does not register the changed data (called "committing the change") and invoke the associated code unless you move to another field (called "changing focus"). Just entering the information and hitting return will often not do anything. The easiest way to ensure that you change focus and your information is "committed" is to use the TAB key to move to the next field. Selecting a different field with the mouse (but not a button, for some unknown reason) will also work. Unfortunately, this is a function of how .pdf forms are implemented. As long as you move from field to field using the TAB key, you should get the expected results.

Note also that the note about this that appears at the top of the form should not appear when you print the form.

General Information

The top part of each section of the form contains information about the aircraft itself and its initial configuration. The fields are:

- Aircraft Name/Designation - self-explanatory, but for information only.
- Mission - choose a mission type. This is for information only.
- Mission ID This is for information only.

Max Payload, Initial Load, Load Status

These fields describe the maximum weight of ordnance and equipment that can be carried by the aircraft (see the Air Mission Form). Both are expressed in kilograms (kg). Max Payload can be found in the Aircraft Data Annex B entry for the aircraft. The initial load must be determined by adding up the hang weights of the ordnance and equipment found in the various Annexes. Note that if you use our Form 2 (Air Mission Form) to describe the aircraft; it will add up the hang weights of the various pieces of equipment, and you can just enter that total into the Initial Load field here. The Max and Initial loads are used to calculate the Initial Load Status. Load status can have one of three values:

- "Unld" - unloaded - no effect on speed or range.
- "Lt" - lightly loaded 60% - 80% of Max Load - no effect on range, but speeds cannot exceed Mach 1.

- “Full”- full load 80% + of Max Load - in addition to being restricted to speeds below Mach 1, range is decreased by 25%.

You can change the load as the mission progresses, and this status will be recalculated.

Cruise Range and Add(itional) Rng expressed in nautical miles (nmi). The initial cruise range and additional range from available drop tanks, conformal fuel tanks, etc. are found in Annex B. Only Cruise Range is required, but the Cruise and additional ranges are added together to get the total initial range.

Ordnance Loadout-for information only

Formation Size - If the aircraft is part of a formation, enter the total number of aircraft here. Formations of more than 8 A/C will use more fuel (*Harpoon V* rules, Formation Table 9.6) and are limited to cruise speed. As formations of less than 9 aircraft do not affect fuel use, a you cannot select "in formation" for mission legs in the section below for smaller formations.

Engine Type - from Annex B.
The type of engine affects the fuel used at various speeds and throttle settings, whether the plane can use afterburner, and whether a propeller plane must use full military power at high altitude.

Ceiling in meters (m) from Annex B
The ceiling of the aircraft determines which speeds need to be entered. For example, if the ceiling of the aircraft is below "High", throttle speeds do not need to be entered for high altitude. The heights of the various altitude bands can be found in the "Altitude Bands" table in chapter 4 of the *Harpoon V* rules. Note that for fuel calculations, aircraft and missiles in NOE and Very Low flight are in the Low altitude band and the "Real High" band is only used by missiles.

Once you enter the ceiling and engine type, the speeds for the available altitudes and throttle settings are opened for entry. These speeds are the maximum speed (in knots) for the throttle settings. If you move slower than the limit of given throttle setting, the fuel use will be calculated as if you were moving at the throttle setting speed. For example, if you have a Cruise speed of 460 kt but move at 400 kt, your fuel use will be calculated as if you were moving at 460 knots.

Mission Profile

The mission is performed as a series of up to 10 "Legs", each of which can have different speed, altitude, and fuel usages. The profile starts with no legs and the "Add New Leg" button available. Pressing this button will add a leg, which will open the required fields for entry and also show a "Calc" button. You must finish a leg by using the Calc button before you start a new one. Also, once you start adding legs, all of the information at the top of the form used in calculations is locked. While you can unlock this information by deleting all of the legs, this will lose any leg information you have entered, it is best to get the top part of the form correct before you start entering legs.

- A "Move" leg requires Speed and Length. The time will be calculated by how far you go.
- A "Loiter" leg requires time (in hours). The plane is assumed not to move and will Loiter and orbit in place, using fuel at 80% of the cruise rate. CAP missions use Loiter to stay on station.
- A "Refuel" leg requires Speed, Distance, and Range Added. It uses 0 Range, as it is assumed that the tanker is supplying all needs. You can put in a distance of 0 if a refueling CAP aircraft does not leave station. You cannot add range that would exceed the maximum range of the plane (internal range + additional range). Also, planes are assumed to be full of fuel when they start, so the first leg cannot be a “refuel” leg.

In most situations, you can change the Load for the leg. Do this first, as it may affect maximum speeds available.

“In Form” determines whether the formation size will affect fuel use for this leg (a check means Yes). This is only available for formations of more than eight aircraft.

Certain fields are calculated as you enter data for the leg. For example, the throttle setting is derived from your altitude and speed.

When you are done entering the required data, press the "Calc" button. This will calculate fuel used and remaining and close the leg. If your fuel remaining drops below 0, the fuel remaining will be displayed in red with parentheses around it, indicating that you need to change something to have a valid profile. The rate that fuel is used is affected by the engine type, throttle setting, altitude band, load, formation. This section incorporates all of the details in the *Harpoon* rules (primarily rule 4.7).

Once a leg is created you can "Edit" or "Del"(ete) it. Changes in “fuel remaining” made in an early leg will propagate to later legs. If you enter a leg by mistake, just finish the calculation and delete it. There is also an option to clear out all of the leg information.

The Example

The example on the Mission Planning Form gives some ideas on how to use the form. While the numbers used in the calculations start with exact values, there can be a reasonable amount of “educated guesswork” as well. When you plan a mission, you want to leave some reserve for the unexpected, so you don’t need to calculate everything exactly. For your missions, clear out all the legs and enter your information.

The sample form shows a prospective mission by two groups of F-18E Super Hornets attacking a target about 400 miles away from their base.

The strike

The first group of 12 aircraft is armed with 6 GBU-54 bombs, 3 drop tanks, and air-to-air missiles. If you have filled out the Aircraft Mission form, you will see that the total load is enough to make the planes “Fully Loaded”, so they use extra fuel and cannot use afterburner or supersonic speed. Also, they are flying in formation, at least at the beginning of the mission (note that this is not normally a part of modern air warfare, but is included to show how the formation works on the form).

During the first leg they cruise out to 360 nmi at medium altitude. Normally cruising at medium altitude would use 360 nmi of range, but the extra load and formation flying increase this to 505.

In leg 2 they go to Full Military Power at low altitude for the attack and break formation during the attack run (planes in formation are restricted to Cruise Speed). Also, they are restricted to FMP because of their load. Even though they only go 40 nmi, they use up 320 nmi of fuel because of the throttle setting and the low altitude. They drop their bombs at the end of leg 2, decreasing their load.

During leg 3 they exit the target area at afterburner. To use afterburner they need to be “Unloaded”, so the load is recalculated after the bombs are dropped. Annex H2 shows that each GBU-54 has a hang weight of 253kg, so 6 of them have a weight of approximately 1500kg. It is perfectly reasonable to use estimates as part of this process. While the hang weight of the the 6 GBU-54 is technically 6 x 253 = 1518 kg, using 1500 for a rough weight is fine. Shedding 1500kg would normally not put the planes into unloaded status (allowing afterburner), but you can also include of an estimate the weight of the fuel they used to get to the target as well. The planning form shows that they have 940 nmi left at the beginning of the leg, so they used 1765 - 940 = 825 nmi of range on the way in. Annex B shows that each drop tank contains 1485kg of fuel (rounded to 1500 for quick calculation) and provides 290 nmi of range. Using 825 nmi of range uses at least 2.5 drop tanks of fuel (actually about 2.8, but 2.5 is fine for estimation), so the weight of the fuel used can be estimated at 1500 x 2.5 = 3750 kg. The bombs dropped + the fuel used will decrease the load by at least 5250 kg, so an estimate of 1200 for the remaining load at the start of the escape leg is reasonable. This causes the load status to be “Unloaded” and afterburner can be used.

In leg 4, the strike hooks up with a tanker - filling the drop tanks and gaining load again up to about 5000kg. This will put their load status as “Lt” (>60% but <80%).

Finally, in leg 5, they go home.

The Escort

These guys have an easier time of it. “Loaded for bear” with a bunch of Air-to-Air missiles and a couple of drop tanks, they fly out 375 miles and Loiter at high altitude for their buddies to eliminate the target and/or they find something to engage. They then

return. The light load and Loiter speeds use much less fuel than the strike and they have plenty of reserve to get them home.