Tomahawk™

A Helicopter Simulation

Datasoft ®

Tomahawk™

PILOT'S HANDBOOK

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INTRODUCING TOMAHAWK

The Tomahawk (AH-64A Apache, Advanced Attack Helicopter) was designed to be the deadliest attack chopper in the sky. And it has just one purpose: seek and destroy aircraft, tanks, artillery, buildings—anything unlucky enough to stand in its way. The Tomahawk's impressive array of weapons and unmatched maneuverability make it the toughest air-war fighter going!

The **Helicopter Aerodynamics** insert gives you detailed information on this state-of-the-art battle machine.

REQUIREMENTS

- Apple®II series computer (64k)
- Compatible disk drive
- Video monitor or TV
- Joystick
- TOMAHAWK game disk
- Aviator's Glasses and Pilot's License

1. Turn off computer and connect a Joystick.
2. Turn on power to monitor or TV.
3. Insert TOMAHAWK into drive and close the door. Turn on computer.

OPTIONS PAGE

Once you've loaded TOMAHAWK, a screen appears showing these selections:

MISSION NUMBER : 1   2   3   4

DAY   NIGHT

CLEAR   CLOUDY

CLOUD BASE

50   250   500   1000   5000   FT

CROSSWINDS AND TURBULENCE

PILOT RATING

TRAINEE PILOT
SQUADRON LEADER
INSTRUCTOR
ACE

SOUND : ON   OFF

COMMENCE MISSION

At the left of this screen, there's an arrow symbol (→). Use the Joystick to move the → up and down between the options. When the → is next to an option, press the fire button to change the highlighted selection.

Example: The → is next to **DAY NIGHT**. If **DAY** is highlighted, press the fire button and **NIGHT** becomes highlighted.

Once you've made all your selections, move the → to **COMMENCE MISSION** and press the fire button to begin gameplay.

See *QUICK REFERENCE GUIDE* for chopper controls.

MISSION NUMBER : 1 2 3 4

1 Flight Training — This Option gives all the excitement of honing your flight and ground-attack skills without the deadly annoyances of enemy ground fire or hostile aircraft (you still have to deal with "Pilot Error," however, so this is not a piece of cake!).

2 Combat — This short mission involves the invasion of four Allied sectors by enemy ground forces. By selecting the Map Mode (press **M**), you'll see the Allied sectors (they flash to indicate the presence of hostile forces). Your mission is to liberate the four sectors by destroying the ground targets (each sector takes approximately 10 minutes to clear). After destroying all targets, complete the mission by landing at the nearest helicopter pad and closing the throttle.

3 Combat — Surrounded totally by enemy territory, your mission is to liberate the entire Map from enemy occupation. Each hostile sector becomes Allied as the ground targets are cleared, allowing you to land and reload with weapons and fuel.

4 Combat — This is a strategic battle for occupation of the entire Map. Your task is to support Allied ground forces in their battle along the front line. As each sector is cleared of enemy ground forces, the front line progresses to the right until you have cleared a complete row of sectors.

If the enemy succeeds in destroying your ground forces, the sector becomes hostile territory and the front line progresses to the *left*. Once a row is completely liberated or occupied, it's out of the game.

NOTE: In all Combat missions, the enemy tries to blow you out of the sky! The quickest defense is to use your laser-guided missiles to destroy the enemy (points scored with missiles are lower than if rockets or guns are used).

In the heat of battle, take care not to land in enemy territory if you're damaged or in need of fuel or ammo. Check for enemy occupation before landing by inspecting the Map.

See **MAP** for an explanation of sectors and using the Map Mode.

DAY or NIGHT

Select **DAY** and the horizon is visible when flying. Select **NIGHT** and you see no horizon; instead, you need to use the Pilots' Night Vision system (Computer–Enhanced Infrared Imaging).

CLEAR or CLOUDY

This gives the option of clear weather or an overcast sky with a selectable cloudbase for instrument flying. **Cloudbase** is selectable from 50 to 5000 feet.

CROSSWINDS and TURBULENCE

This gives variable crosswind and turbulence effects.
Warning: For experienced pilots only!

PILOT RATING

This sets the difficulty level of the mission. With each increase in pilot rating, the enemy's accuracy doubles!

WARNING SYSTEM

Diving—Maximum permissible speed in a dive is 197 knots. If the speed rises above this, your Speed indicator flashes. The chopper sheds a rotor blade at 210 knots!

Torque—If you demand too much engine Torque (Overtorque), you're engine temperature increases. If you ignore this, the engines eventually cough oil and die.

INSTRUMENT PANEL

See the *QUICK REFERENCE GUIDE* for a numbered illustration of the Instrument Panel. The items on the Panel are described in detail below.

1 Collective Lever

This control lets the Tomahawk get off the ground and hover. Once you're in flight, use the Collective Lever to control forward thrust.

2 Torque %

This is the amount of force that's exerted on the engines to make the chopper dive, climb, etc.

3 RPM %

This shows the Revolutions Per Minute of the engines and rotors.

4 Fuel Level

This indicator shows how much fuel is in reserve. To refuel, taxi onto a helipad (NOT an enemy's!) and close the throttle (**S**) to bring engine and rotor RPM to zero. The chopper will immediately be serviced and prepared for takeoff. Follow this same procedure when you need repairs or more ammunition.

5 Throttle Indicator

This shows the engine RPM. Usually, you keep the throttle fully open (**W**) while flying. **S** closes the throttle.

4

6 TADS

The Target Acquisition & Designation System (TADS) is used to identify and track enemy and Allied tanks, field guns, and helicopters. When you "lock on" to a target, an icon of that target appears in the lower part of the TADS display.

The upper part of the display shows range in feet when the target is less than 10,000 feet away. When the target is further than 10,000 feet, the TADS display shows //////.

7 Temperature Gauge

This indicator lets you know how hot your engines are. If the engines get too hot, they'll die.

8 Pilot's Visual Display Unit

This gives vital information about speed, altitude, how far you are from your target, and how long it will take to get there.

A (Altitude)

This display shows your altitude in feet.

SPD (Speed)

This readout shows numbers on a black background when you're travelling forward; numbers on a white background mean you're travelling backwards.

VSI (Vertical Speed Indicator)

This shows your speed (in feet per second) when climbing or diving. A black background shows you're climbing and a white background indicates you're diving.

ET (Estimated Time)

This tells how long it will take you to reach the target, based on your current speed. The time is shown in hours and minutes (the display shows Ø if less than one minute). If the selected target has already been destroyed, this display shows //////.
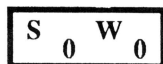
RANGE

This auto-ranging navigation computer constantly updates you on your distance from the target:

Within 0.1 miles—readout is in feet
Within 4.9 miles—readout is in tenths of a mile
Over 5 miles—readout is in miles

When the readout changes from Miles, the distances are shown by compass direction (North, South, East, and West).

```
┌─────────────┐
│  S     W    │
│     0     0 │
└─────────────┘
```

If the selected target has already been destroyed, this display shows //////.

9 Artificial Horizon

a) Roll Symbol
This shows a visual image of the helicopter's angle in relation to the ground.

b) Left or Right Roll
This indicates whether the chopper's roll is to the left or right (**L** or **R**).

c) Pitch Angle
This shows how steeply you're climbing or diving.

d) Roll Angle
This indicates, numerically, the degree of the chopper's angle in relation to the ground.

e) Sideslip (Drift) Indicator
This indicates how much the helicopter moves left or right in relation to a straight and level flight (this indicator should usually stay right in the middle).

10 Doppler (Radar) Navigation/Compass

This gives you readouts of the helicopter's Heading, Bearing, and Track. A chopper can be pointing in one direction (Heading) but travelling in another (Track). This is because a chopper can fly sideways and backwards as well as forward. Match the Heading to the Bearing to intercept the target (the flashing dot shows the relative Bearing of the target).

a) Heading

This shows which direction the helicopter is pointing.

b) Track

This shows you the direction you're flying in.

c) Doppler Mode and Number

This shows the method of tracking you're using (see below) and which element of that method is active.

d) Bearing

This shows the Heading needed for pointing at the objective.

Press **C** to select one of the four Doppler (radar) modes:

B — Beacon navigation lets you "lock on" to Beacons for guidance (there are 8 Beacons on the Map, Ø–7).

H — Home guidance lets you find the closest Allied Landing Pad (there are 4 Landing Pads per sector, Ø–3).

T — Target tracking lets you home in on enemy ground targets (there are 8 targets per sector, Ø–7).

Lightning Symbol — This provides enemy helicopter interception (a flashing lightning symbol warns of an approaching enemy chopper).

Once you're in **B**, **H**, or **T** Mode, select a new Beacon, Landing Pad, or Target by pressing **N**.

Example: You're in Beacon Mode. Each time you press **N**, the Range readout tells you how far away the selected Beacon is and the Time readout tells you how long it will take to reach it (see Instrument Panel illustration on the *QUICK REFERENCE GUIDE* for Range and Time readouts).

11 Failure Status Panel

The elements in this display let you know whether everything is in working order. A black backgound means everything is OK; flashing red indicates a failure in the system.

E   Engines
W   Weapons
N   Navigation Computer
T   TADS

12 Score

This panel shows you how well you're doing.

Weapon Used	Field Gun	Tank	Helicopter
Chain Gun	20	—	100
Rockets	10	20	50
Missiles	05	10	25

Target (column header spanning Field Gun, Tank, Helicopter)

If you destroy Allied forces, you lose all your points (Allied forces are blue, enemy forces are red).

13 Weapons

This display lets you see how much ammunition you have for each type of weapon: Chain Gun, Rocket Launcher, and Missile Launcher.
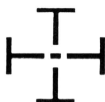
GUN   30mm Chain Gun Ammo
RK   Rockets
M   Hellfire Missiles

8

Here are the important details on the weapons aboard the Tomahawk:

Chain Gun — Diagonal Sights;
Range – 2,000 feet; holds 1200 rounds of
30mm ammunition; fires 750 rounds per minute

Rockets — Vertical/Horizontal Sights;
Range – 4,000 feet; you have 38 unguided
Rockets (19 on each side)

Missiles — Square Sights;
Range – 3.1 miles; you have 8 laser-guided,
auto–tracking Hellfire Missiles
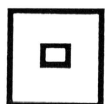
WEAPONS SYSTEMS & TARGET ATTACK

You can activate Weapons Sytems when you're in Ground Attack or Air-to-Air Mode (press **C** until you see weapons sights on your screen). Press **P** to select Chain Gun, Rockets, or Missiles.

NOTE: Your helicopter must be in the air before you can fire at the enemy. Use the Joystick Fire Button to shoot.

When using the Chain Gun or Rockets, the target must be visible in your sights before you fire.

When you launch a Missile, it locks on to any hostile target passing through the sights. Once the Missile is locked on, you'll see a solid square on the TADS display; tracking is automatic as long as the target remains on–screen.

A warning symbol flashes on the Doppler indicator when an enemy chopper approaches (if you aren't in Air-to-Air Mode). Immediately select Air-to-Air Mode (press **C** until you get the lightning symbol) and shoot the enemy out of the sky before he gets too close!

A good strategy for lower-skilled pilots is to begin an attack with the Chain Gun and Rockets. Once you've done some initial damage, use the Missiles to finish off the enemy.

During combat, enemy fire is indicated by flak. The screen flashes if your chopper is hit.

Damage to your helicopter systems shows on the Failure Status Panel; the Doppler helicopter symbol flashes when you have structural damage. Three structural hits are fatal!

To repair your chopper, get more ammunition, or refuel, set down on a helipad (NOT an enemy's!) and close the throttle (**S**) to bring engine and rotor RPM to zero. The chopper will immediately be serviced and prepared for takeoff.

MISSION COMPLETION

You've completed a Mission when all enemy ground forces are destroyed and you return safely to a Landing Pad. After touchdown, close the Throttle to bring the engine and rotor RPM to zero. A Mission Report follows.

3D REAL-WORLD DISPLAY

The 3D terrain you fly over features buildings, Landing Pads, transmission pylons, trees, mountains, enemy tanks, field guns, and helicopters. Fly below 500 feet and the texture of the ground becomes visible.

Though it's possible to fly between trees and mountains, it takes a bit of practice (and not a few mangled Tomahawks).

MAP

The Map is divided into 16 rows of 8 sectors. Each sector contains 8 enemy targets, field guns and/or tanks, giving a total of 1024 targets across the Map.

Use **M** to select the Map screen or to return to normal display from the Map.

When you're in Map Mode, use Beacons Ø–7 for navigation. You and the enemy are represented by white helicopter symbols; the enemy choppers are flashing.

After destroying all targets in one sector, proceed to the adjacent sector. Refuel and reload with ammo as necessary.

To move from one sector to another, land on an Allied helipad. Select the Map Mode, then use the Joystick to move to another sector. **NOTE:** You can't use this method to move to another helipad in the *same* sector.

In **Mission 1**, all sectors are Allied; any Landing Pad is safe for refuelling, rearming, and repairs. However, all sectors do contain enemy tanks and field guns for target practice.

In **Combat Missions (2–4)**, Allied territory is Blue and enemy territory is Red. A flashing Blue sector means there are enemy forces in Allied territory. A flashing Red sector indicates Allied forces in the enemy territory. If you touch down in a hostile sector, you'll be captured by the enemy.

The destruction of all enemy forces in a Red sector results in the sector becoming Allied. If all Allied forces in a Blue sector are destroyed, that territory becomes hostile.

FLYING THE TOMAHAWK

Helicopters are naturally unstable and difficult to fly without Autostabilization. The Tomahawk is fitted with Digital Automatic Stabilization Equipment (DASE), making it far easier to fly than most modern choppers.

Getting Off the Ground

The following are step-by-step instructions for getting your Tomahawk into the air.

1   Make sure the Collective indicator is at the minimum setting;

2   Hold down **W** until Throttle indicator is at maximum setting;

3   Wait for engine RPM and rotor RPM to reach 100%;

4   Hold down **Q** until lift-off occurs (VSI shows vertical speed in feet per second);

5   Press **A** until VSI shows Ø; the chopper is now hovering above the landing pad;

6   Use left (**Z**) or right (**X**) rudder to turn on the spot.

Flying Forward from a Hover

Once you're in the air, your next step is to learn how to use your chopper as transportation.

1 Increase the Collective (**Q**) to between 80% and 100% Torque. If you see the Overtorque warning, reduce the Collective (**A**).

2 Tilt nose of chopper downwards (Joystick FORWARD) to between 15 and 30 degrees. Speed increases and autostabilizers slowly raise the nose of the helicopter to level flight.

3 Reduce Collective (**A**) until VSI is Ø feet per second (not climbing or descending).

The Tomahawk is an extremely agile chopper; from a stable hover you can reach 100 knots in about six seconds by pulling 100% Torque and tilting the nose down to approximately 30 degrees.

Forward speed is related primarily to the Torque setting and, hence, the Collective Lever setting. Typical Torque/speed settings are:

Torque	Speed
044%	60 knots
060%	119 knots
075%	147 knots
100%	159 knots

These values vary with altitude and changes in the chopper's weight (resulting from fuel and ammo consumption). The Tomahawk has a computer–controlled stabilizer which, when the fuselage is level, lets the helicopter cruise at any speed.

Turning the Chopper

If the forward speed is 60 knots or faster, simply bank left or right (use the Joystick) to turn. Some vertical lift is lost when turning and the chopper will start to descend; correct this by increasing the Collective (**Q**). The helicopter tends to slow down in a turn unless the pilot compensates by diving (sacrifice height to maintain speed).

At speeds under 60 knots, the helicopter tends to drift into the turn (see the Sideslip indicator on the Artificial Horizon). You can adjust this by using the rudder, but it reduces forward speed.

Fluctuations in rotor RPM occur during a turn because of gravitational force effects. An Autothrottle adjusts the engine RPM accordingly to keep the rotor RPM at approximately 100%.

Slowing Down & Returning to a Hover

1   Pull back on the Joystick to gently raise the chopper's nose (the helicopter slows down and climbs). Maintain the nose–up attitude by repeatedly — and *gently* — pulling back on the Joystick.

Keep the VSI at approximately Ø by reducing the Collective (A) to reduce the rate of climb. As the forward speed drops to below 60 knots, increase the Collective (Q) to counteract the rate at which the helicopter is falling. Let the nose of the chopper return to level flight as the speed approaches zero.

Adjust the Collective as necessary to achieve a VSI of Ø. The chopper should now be in a stable hover.

2   Banking repeatedly left and right (use Joystick) is another method of slowing down (as long as you aren't diving!).

3   If the forward speed is less than 60 knots, apply the rudder to increase sideslip; this slows you down dramatically as a result of the drag force generated.

Landing
You can land from a hover or at forward speeds of less than 60 knots.

From Hover
Lower the Collective (A) to maintain a steady rate of descent (maximum VSI at touchdown is 12 feet per second). Ground cushion effect will be experienced at 30 feet, resulting in a reduction of the descent rate.

Rolling Touchdown

With a forward speed of less than 60 knots, gently lower the Collective (**A**) to begin descent (maximum VSI at touchdown is 12 feet per second). After touchdown, the chopper slows down and eventually stops. Steer on the ground (taxi) by using rudder control (**Z** and **X**).

Taxiing on the Ground

You can taxi the helicopter on the ground up to a speed of 60 knots as long as the engine and rotor rpms are at 100%. With the chopper stationary, raise the Collective (**Q**) to produce about 20% Torque. Push forward on the Joystick to accelerate (pull back to slow down) and use the rudder (**Z** and **X**) to steer.

Backward & Sideways Flight

Starting from a hover, fly backwards by increasing the Collective (**Q**) and raising the nose to approximately 10 degrees. The Speed readout (see Instrument Panel illustration on *QUICK REFERENCE GUIDE*) turns white to denote backward flight. Keep the nose up to sustain speed.

Fly sideways by rolling left or right (use Joystick) and raising the Collective (**Q**). The Speed readout doesn't show sideways speed. Watch the sideslip indicator to monitor sideways drift.

Torque Turn

Make sure your speed is 100 knots or more. Pull the chopper's nose up to about 70 degrees. Hold this nose–up attitude until the speed drops to about 60 knots. Release Joystick and apply rudder (**Z** or **X**) until Heading has changed by approximately 160 degrees. Release rudder, adjust roll to zero (if necessary), and accelerate with the nose down.

Aerobatics

The Tomahawk may be flown safely within the following limits:

Pitch ± 90 degrees
Roll ± 110 degrees

Loops and Rolls are NOT recommended!

Autorotation

Autorotation is equivalent to the helicopter "gliding" through the air and is used when the pilot wants to descend rapidly or after engine failure.

During Autorotation, the rotor blades are driven by airflow through the rotor disc as the helicopter descends. This reduces the power required from the engines (especially helpful if there *is* no power!) and the engine RPM is automatically reduced to maintain 100% rotor speed. The "split" between engine RPM and rotor RPM can be seen on the Instrument Panel (see *QUICK REFERENCE GUIDE*).

Autorotation is best performed at approximately 60 knots and above 500 feet. Begin Autorotation by gently lowering the Collective (**A**):

Engines Active

As the descent rate builds up, the automatic Throttle control reduces the engine RPM. Any fluctuations in rotor RPM are compensated for automatically by the Autothrottle. As the altitude falls to below 200 feet, increase the Collective (**Q**) to reduce the rate of descent and raise the nose of the chopper to slow down. With practice, you can co-ordinate increasing the Collective and adjusting the pitch angle in order to slow down to hover just a few feet above the ground.

Engine-Off Landings

If both engines fail or if you deliberately close the Throttle in flight, engine RPM reduces to zero. You must act quickly to decrease the Collective (**A**) before the rotor blades slow down too much (CRASH!). Rotor RPM is controlled during descent by careful adjustment of the Collective: keep the chopper level and the speed between 50 and 60 knots; raise the Collective (**Q**) just before touchdown to bring the rate of descent to less than 12 feet per second.

Aerobatics These are fancy flying feats and maneuvers.

Artificial Horizon
 This is a display on the Instrument Panel that gives the pilot a graphic representation of the helicopter's position in relation to the ground.

Autorotation This is a method for landing a helicopter without using engine power.

Autothrottle This is a special feature of the Tomahawk that compensates for variables in the rotor RPM and keeps the engine RPM at 100%.

Beacon These are towers located around the Map for navigation purposes.

Bearing This is the direction the nose should point during flight in order to reach the objective.

Collective A flight control that changes the torque of the rotor, thus affecting its force in lifting the chopper off the ground and keeping it in flight.

DASE Digital Automatic Stabilization Equipment that makes the Tomahawk easier to fly than other helicopters.

Doppler This is the specialized radar system used by the Tomahawk.

ET This is the Estimated Time of arrival at the target.

Failure Status Panel
 This is the readout on the helicopter's Instrument Panel that lets the pilot know whether all systems are in proper working order.

Heading This is the direction the helicopter's nose is pointing.

Hover This is the term used to describe a helicopter's situation when it is airborne but staying in one spot.

Knot	This is a rate of speed: one nautical mile per hour.
Landing Pad	Also called helipads, these are the spots where the helicopter can set down.

Night Vision System
This is the Computer Enhanced Infrared Imaging system that lets the pilot "see" in the dark.

Objective	This is the helicopter's target or destination.
Pitch	This is the angle of the helicopter's nose in relation to the ground (climbing or diving).
Range	This is the distance from your current position to the objective.
Roll	This is the helicopter's horizontal angle in relation to the ground (rocking back and forth).
RPM	Rotations Per Minute.
Sideslip	This term refers to how much the helicopter drifts left or right when in straight flight.
TADS	Target Acquisition & Designation System: A system for tracking and sighting targets that interfaces directly with the helicopter's weapons.
Taxi	This is the term used when a chopper is rolling along the ground.
Torque	The rotational force exerted on turbine engines.
Track	This is the actual direction of flight.
VSI	Vertical Speed Indicator: A cockpit display that shows how fast the helicopter is ascending or descending. If the chopper is in level flight, the readout is zero.

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Tomahawk™

QUICK REFERENCE GUIDE

This *QUICK REFERENCE GUIDE* is designed for your convenience in playing TOMAHAWK. For more detailed information about the elements in this guide, refer to the *PILOT'S HANDBOOK*.

HELICOPTER CONTROLS

JOYSTICK:

Roll Left — Joystick LEFT   Pitch Up —— Pull BACK on Joystick

Roll Right— Joystick RIGHT   Pitch Down — Push FORWARD on Joystick

KEYBOARD:

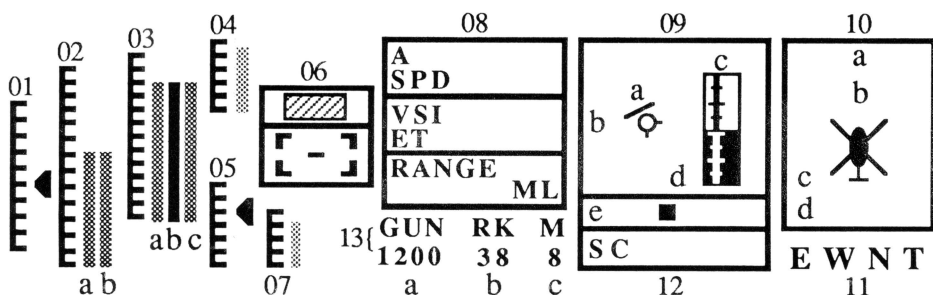|			
Z	LEFT Rudder	**W**	Open THROTTLE
X	RIGHT Rudder	**S**	Close THROTTLE
C	Change Doppler Mode	**Q**	Increase Collective
N	Next Objective	**A**	Decrease Collective
P	Select Weapon System	**H**	Pause
M	Map	**J**	Continue

CONTROL R — Abort Mission & Return to Selection Screen

INSTRUMENT PANEL

01 Collective Lever

02 Torque %
   a Engine 1
   b Engine 2

03 RPM %
   a Engine 1
   b Rotor Blades
   c Engine 2

04 Fuel Level

05 Throttle Indicator

06 TADS (Target Acquisition & Designation System)

07 Temperature Gauge

08 Pilot's Visual Display Unit
   A (Altitude, in Feet)
   SPD (Speed, in Knots)
      Black=Forward
      White=Backward
   VSI (in Feet Per Second)
   ET (in Hours & Minutes)
   RANGE (in Miles)

09 Artificial Horizon
   a Roll Symbol
   b Left or Right Roll
   c Pitch Angle
   d Roll Angle
   e Sideslip (Drift) Indicator

10 Doppler Navigation/Compass
   a Heading
   b Track
   c Doppler Mode & Number
   d Bearing

11 Failure Status Panel
   E Engines
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   T TADS

12 Score

13 Weapons
   GUN 30mm Chain-Gun Amm
   RK Rockets
   M Hellfire Missiles

Datasoft ®
HOME COMPUTER SOFTWARE

Tomahawk ™

DEMO

CAT. NO. 1590