

ChessMFD

Orbiter Chess

User Manual

Version 1.0

An Orbiter Spaceflight Simulator Multi-Functional Display Module

Author: Dimitris "dgatsoulis" Gatsoulis

*Dedicated to the loving memory of
Matthaios "MrMatgf" Gatsoulis*

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1. Introduction

ChessMFD ("Orbiter Chess") turns any Multi-Functional Display in Orbiter Spaceflight Simulator into a complete chess set: a full game of chess against a genuinely strong built-in engine, played entirely from the MFD buttons or the keyboard, without ever leaving the cockpit.

Whether you want a quick game while coasting to apoapsis, a serious challenge at Expert strength during a long interplanetary cruise, or a few tactics puzzles while waiting for a launch window, ChessMFD brings the complete over-the-board experience to your instrument panel - with spoken move narration, sound effects, an animated evaluation bar, and full support for your own board and piece artwork.

Key Features

- A complete chess implementation: all rules including castling, en passant, promotion, threefold repetition, the fifty-move rule, and insufficient-material draws
- A strong built-in engine (approximately 2000+ Elo at full strength) with four adjustable strength levels, from Novice to Expert
- Human-like play at lower levels: the weaker settings make natural mistakes rather than playing artificially crippled chess
- Opening book and endgame book support via simple, user-editable text files
- A built-in tactics puzzle trainer with categorized puzzles loaded from a plain-text file
- Voice narration of every move through Windows text-to-speech (SAPI), with selectable voices
- Sound effects for moves, captures, castling, check, checkmate, and draws via XRSound (optional)
- An animated evaluation bar showing who is better - live, even while the AI is thinking
- Last-move arrows, move history in standard algebraic notation, and captured-piece displays
- A board editor: set up any position manually, paste a FEN string, or type a compact piece list
- Save and load games at any time; every save also exports a standard PGN file
- Full game-state persistence in Orbiter scenario files - your game survives quicksaves and scenario reloads
- Custom board and piece graphics: drop BMP files into a folder and select them from the configuration screen (Section 16)
- Play as White or Black, flip the board view at any time, or let the AI play both sides

2. System Requirements

Minimum Requirements

- Operating System: Windows 10 or later
- Orbiter Version: Orbiter 2016 or later (Orbiter 2024 recommended)
- Processor: Any dual-core CPU
- Memory: 4 GB RAM
- Sound: Any Windows-compatible audio device (for narration and sound effects)
- Storage: Less than 5 MB, plus your optional custom graphics

Note:

ChessMFD is deliberately lightweight. The engine runs on a background thread and only while it is actually thinking, so the simulation stays smooth even at Expert strength. Voice narration uses the text-to-speech engine built into Windows - there is nothing extra to install. Sound effects require XRSound, but ChessMFD works fully without it.

3. Installation

Download the ChessMFD package.

Extract the contents into your Orbiter installation root folder.

Confirm the folder structure matches Section 3.1 below.

Launch Orbiter, load any scenario, and select "Chess" from the MFD mode menu.

3.1 Folder Structure

The package installs the plugin DLL, a data folder for books, puzzles and saved games, a texture folder for board and piece artwork, and a sound folder used by XRSound:

```
Orbiter/
├─ Modules/
│   └─ Plugin/
│       └─ ChessMFD.dll
├─ Config/
│   └─ ChessMFD/
│       ├── ChessMFD_OpeningBook.txt
│       ├── ChessMFD_EndgameBook.txt
│       ├── ChessMFD_Puzzles.txt
│       ├── ChessMFD_saved_game.txt (created on first save)
│       └─ ChessMFD_game.pgn (created on first save)
├─ Textures/
│   └─ ChessMFD/
│       ├── Boards/ (optional custom board BMPs - Section 16)
│       └─ Pieces/ (optional custom piece-set BMPs - Section 16)
└─ XRSound/
    └─ ChessMFD/ (sound effect WAVs - Section 14)
```

Note:

If a data file is missing, ChessMFD simply runs without that feature (for example, "no puzzles found") and writes a line to Orbiter.log explaining what it could not find. Nothing is required except the DLL itself.

3.2 Disabling or Uninstalling the Module

ChessMFD can be deactivated like any other plugin by unticking it in the Launchpad's Modules tab.

To uninstall completely, close Orbiter, then delete Modules\Plugin\ChessMFD.dll and the Config\ChessMFD, Textures\ChessMFD, and XRSound\ChessMFD folders. If you want to keep your saved game, opening book edits, or puzzles, back up the Config\ChessMFD folder first.

4. Data Files

ChessMFD reads its books, puzzles, and saved games from ordinary plain-text files in Config\ChessMFD. All of them can be viewed and edited in any text editor, and all of them are optional.

4.1 The Opening Book

ChessMFD_OpeningBook.txt maps positions to good moves. Each line holds a position in FEN notation and a move, separated by a vertical bar:

```
rnbqkbnr/pppppppp/8/8/8/8/PPPPPPPP/RNBQKBNR w KQkq - | e2e4
```

A position may appear on several lines with different moves - the AI will pick between them, which keeps its opening play varied. The books are loaded in the background when the MFD starts, so even a large book does not delay the simulation.

4.2 The Endgame Book

ChessMFD_EndgameBook.txt uses the same one-line-per-entry format and teaches the engine known endgame technique. When the position on the board matches an entry, the AI plays the book move directly.

4.3 Puzzles

ChessMFD_Puzzles.txt holds the tactics trainer's content. Each line is one puzzle, with four fields separated by vertical bars:

```
Category|FEN|solution moves|Description  
Mate in 2|r1b2k1r/.../R3K2R w KQ - 0 1|d1d8 e8d8 h1d1|Back rank  
combination
```

The solution is a space-separated list of moves in coordinate notation (e2e4, e7e8q for a promotion). Puzzles are grouped by their category name in the puzzle menu, so you can organize them however you like - "Mate in 1", "Forks", "My blunders", anything.

4.4 Sound Effects

The WAV files in XRSound\ChessMFD can be replaced with any sounds you prefer, as long as the filenames stay the same. See Section 14 for the full list.

4.5 Saved Games

ChessMFD_saved_game.txt is the single save slot used by Save Game / Load Game (Section 11). ChessMFD_game.pgn is a standard PGN export of the current game, refreshed on every save - you can open it in any chess program or paste it into an online analysis board.

5. Activating the MFD

Launch Orbiter and load any scenario.

Enter the cockpit view of your vessel.

Select "Chess" from the MFD mode menu.

The chess board appears, set up for a new game with you playing White.

6. The Main Screen

The display is dominated by the board, drawn with the currently selected board and piece artwork. Around it, ChessMFD shows:

- The status line - whose turn it is, check warnings, and game results
- The move history - the game so far in standard algebraic notation (toggleable)
- Captured pieces - what each side has won so far
- The evaluation bar - a White-versus-Black bar showing who stands better (Section 15)
- The cursor - a yellow square you steer with the arrow buttons; a green frame marks the currently selected piece, and its legal destination squares are highlighted
- The last-move arrow - an arrow showing the move just played, including the bent path of a knight (toggleable)

7. Playing a Game

7.1 Controls

Button	Keyboard	Function
MNU	M	Open the main menu (New Game, Save, Load, Puzzles)
SWI	X	Flip the board - view from the other side
AI	F	Toggle AI control - hand your side to the engine / play the other side
UND	U	Undo the last move
SET	T	Open the board editor (Section 10)
CFG	C	Open the configuration screen (Section 12)
UP / DWN	W / S	Move the cursor up / down
LFT / RHT	A / D	Move the cursor left / right
SEL	E	Select the piece under the cursor / move it to the cursor square
RES	Q	Resign the game (with confirmation)
-	Space	Cancel the current selection

7.2 Making a Move

Steer the cursor to one of your pieces and press SEL - the piece is framed in green and every square it can legally move to is highlighted. Steer the cursor to a destination square and press SEL again to play the move. Pressing SEL on the selected piece itself, or pressing Space, cancels the selection.

Only legal moves are accepted. If a move would leave your king in check, the destination simply is not offered.

7.3 Pawn Promotion

When a pawn reaches the last rank, a promotion screen appears. Use LFT/RHT (A/D) to choose between Queen, Rook, Bishop, and Knight, then confirm with SEL. Escape cancels the move entirely.

7.4 Undo and Resign

UND takes back the last move played - press it twice to take back a full move pair when playing the AI. RES resigns the game after a Yes/No confirmation.

7.5 Switching Sides and the AI Button

SWI flips the board so you view the position from the other side - useful when playing Black, or on shared screens. The AI button hands your current side to the engine and gives you the other one; press it while it is your move and the engine will take over and reply, effectively letting you swap colors mid-game or watch the engine play itself.

7.6 How Games End

ChessMFD recognizes checkmate, stalemate, draw by threefold repetition, draw by the fifty-move rule, and draw by insufficient material, and announces each in the status line (and aloud, if narration is on). Resignation is always available through RES.

8. The AI Opponent

8.1 Strength Levels

The AI Strength setting in the configuration screen (Section 12) offers four levels:

Level	Character
Novice	Plays quickly, follows the book only briefly, and makes frequent human-like mistakes - a fair opponent for beginners
Intermediate	Thinks longer, blunders rarely, still allows the occasional inaccuracy - solid club-beginner level
Advanced	Strong, purposeful play with only rare slips - a challenge for experienced players
Expert	Full engine strength: deep adaptive search, complete book usage, and no deliberate errors - approximately 2000+ Elo

Note:

The lower levels do not play artificially restricted chess. Instead, the engine finds a strong move and then - with a probability that depends on the level - deliberately chooses a plausible, slightly inferior alternative, the way a human opponent goes wrong. The result feels like playing a person, not a broken machine.

8.2 Thinking Time

At Expert level the engine budgets its own time: roughly five seconds for routine positions, extending automatically up to twenty seconds in endgames (where precision matters most) and in check situations, and spending less in the opening while the book still applies. It also stops early when the best move is clear, so it rarely keeps you waiting without reason. A live node counter and search score are shown while it thinks.

8.3 Book Usage

In the opening, the AI plays instantly from the opening book for as long as the position stays in book (and adds a short, natural pause so it does not feel robotic). In simplified positions it consults the endgame book the same way. Both books are plain text files you can extend yourself (Section 4).

9. Puzzles

Choose Solve a Puzzle from the main menu to open the puzzle category list, populated from ChessMFD_Puzzles.txt (Section 4.3). Pick a category and ChessMFD selects a random puzzle from it: the position is set up on the board, and the description line tells you what to look for.

Enter your move exactly as in a normal game - cursor, SEL, move. A correct move is confirmed and the opponent's reply from the solution is played automatically; an incorrect move is rejected with a sound and you can try again. Promotions are part of many solutions - the promotion screen appears normally and your chosen piece is checked against the solution.

When the final move is played, "Puzzle Solved!" appears - press SEL to continue.

10. The Board Editor

Press SET to open the board setup tools. Three ways to build a position are offered:

10.1 Manual Setup

Edit the board square by square: steer the cursor, press SEL, and choose a piece (or Empty) to place there from the piece palette. The status line shows the cursor's coordinates while you work.

10.2 FEN Import

Choose the FEN option and paste or type a standard FEN string into the text box. This is the quickest way to bring in a position from a book, a website, or another chess program.

10.3 Custom Piece List

Alternatively, type a compact list of placements in the form square=piece, separated by spaces or commas, optionally starting with the side to move:

```
white e1=K e8=k d1=Q a7=P
```

Uppercase letters are White pieces, lowercase are Black (K/Q/R/B/N/P). Anything not listed is left empty.

10.4 Validation

Before a position goes live, ChessMFD checks that it is playable: exactly one king per side and at least one legal move for the side chosen to move. Invalid setups are rejected with a message rather than producing a broken game.

11. Saving and Loading

Save Game in the main menu writes the current position, your side, the board orientation, and the game status to Config\ChessMFD\ChessMFD_saved_game.txt. Load Game restores it at any time - including in a different Orbiter session or a different scenario.

Every save also refreshes Config\ChessMFD\ChessMFD_game.pgn, a standard PGN export of the full game so far, ready to be opened in any chess software for analysis or archiving.

Note:

Independently of manual saves, the complete game state - position, full move history, and your settings - is stored inside Orbiter scenario files. Quicksave in the middle of a game, and the game is exactly where you left it when the scenario loads again.

12. Configuration

Press CFG to open the configuration screen. Use UP/DOWN to highlight a row and SEL (or LFT/RHT where applicable) to change it; settings are applied when you confirm, and stored in the scenario:

Setting	Function
Board Style	Selects the board artwork: the built-in wooden board or any BMP from Textures\ChessMFD\Boards (Section 16)
Piece Style	Selects the piece set: the built-in set or any sprite sheet from Textures\ChessMFD\Pieces (Section 16)
Narration Voice	Chooses among the text-to-speech voices installed in Windows
Show Move History	Shows or hides the algebraic move list
Show Move Arrows	Shows or hides the last-move arrow
Sounds	Enables or disables all XRSound sound effects
Narration	Enables or disables spoken moves and announcements
Evaluation Bar	Shows or hides the evaluation bar (Section 15)
AI Strength	Novice / Intermediate / Advanced / Expert (Section 8)

13. Voice Narration

With narration enabled, ChessMFD speaks every move in natural language - "Knight to f3", "Queen takes e5, check", "Castles kingside", "e8, promoting to Queen, checkmate" - along with game events such as saves, draws, and results. Narration uses the Microsoft Speech API (SAPI) built into every Windows installation; any voice installed on your system can be selected from the configuration screen.

Speech is asynchronous: a new announcement simply replaces one still in progress, and the simulation is never delayed.

Tip:

Additional voices can be installed from Windows Settings under Time & Language > Speech. Newly installed voices appear in ChessMFD's voice list the next time the MFD is opened.

14. Sound Effects

If XRSound is installed, ChessMFD plays a short sound for each game event. The WAV files live in XRSound\ChessMFD and can be replaced with your own (keep the filenames):

File	Played when
new_game.wav	A new game starts
move.wav	A quiet move is played
capture.wav	A piece is captured

castling.wav	Either side castles
check.wav	A move gives check
checkmate.wav	The game ends in checkmate
draw.wav	The game ends in a draw
invalid.wav	An illegal action is attempted

Note:

XRSound is optional. Without it, ChessMFD is simply silent apart from voice narration, which is independent of XRSound.

15. The Evaluation Bar

The evaluation bar is a vertical White-versus-Black gauge next to the board: the larger the white portion, the better White stands. After each move it settles smoothly to the engine's assessment of the position; while the AI is thinking, it tracks the search's live score in real time, so you can watch the engine's opinion form - and see immediately when you have blundered or when the AI realizes it is losing.

A completely one-sided bar indicates a decided game (mate found or a resignation-level advantage). The bar can be hidden from the configuration screen if you prefer to form your own judgment.

16. Custom Boards and Pieces

ChessMFD's artwork is fully user-extensible. Any BMP files you place in the texture folders are discovered automatically and appear in the configuration screen's Board Style and Piece Style lists under their file names - no configuration files to edit, no rebuilding, nothing to register.

16.1 Custom Boards

Place board images in:

Orbiter/Textures/ChessMFD/Boards/

Requirements:

- Format: Windows BMP (24-bit recommended)
- Size: 1024 x 1024 pixels - the image is drawn as the complete 8 x 8 board and stretched to fit the MFD
- Layout: the full board including the squares themselves; light square in the bottom-right corner (a1 dark), as on a real board

The file name (without extension) is what appears in the Board Style list, so name your files descriptively: Walnut.bmp, GlassBlue.bmp, TournamentGreen.bmp.

16.2 Custom Piece Sets

Place piece sprite sheets in:

Orbiter/Textures/ChessMFD/Pieces/

A piece set is a single BMP sprite sheet containing all twelve pieces in a fixed grid:

- Sheet size: 1536 x 512 pixels - six columns and two rows of 256 x 256 pixel sprites
- Column order (left to right): King, Queen, Bishop, Knight, Rook, Pawn
- Rows: White pieces in the top row, Black pieces in the bottom row
- Transparency: pure magenta, RGB(255, 0, 255), is treated as transparent - fill the background of every sprite with it

Each 256 x 256 cell is scaled down to one board square, so draw the pieces large, centered in their cells, with a small margin. Anti-aliasing against the magenta background can leave a faint pink fringe at low MFD resolutions - for the cleanest result, use hard edges or anti-alias against a color close to your piece outlines.

16.3 Activating Your Artwork

New files are discovered when the Chess MFD is (re)opened - switch the MFD to another mode and back, or use the configuration screen in a fresh MFD instance, then pick your artwork under Board Style / Piece Style. Your selection is remembered in the scenario. If a custom file fails to load (wrong format, wrong location), ChessMFD writes the reason to Orbiter.log and falls back to the built-in artwork rather than showing a broken board.

17. Troubleshooting

No Sound Effects

Confirm XRSound is installed and enabled for your vessel, the Sounds setting is On (Section 12), and the WAV files exist in XRSound\ChessMFD. Narration is independent of XRSound - if you hear speech but no effects, XRSound is the missing piece.

No Voice Narration

Confirm Narration is On and a voice is selected in the configuration screen. If the voice list shows "None Found", no SAPI voices are visible to Orbiter - check Windows Settings > Time & Language > Speech. Note that 32-bit applications (Orbiter) use the 32-bit SAPI voice registry; most standard Windows voices are available there.

The AI Never Uses Its Book / No Puzzles Found

The corresponding text file is missing or unreadable - check for the exact filenames in Config\ChessMFD (Section 4) and look for ChessMFD lines in Orbiter.log stating which file could not be opened.

Custom Board or Pieces Don't Appear in the List

Confirm the files are BMP format (not PNG or JPG renamed to .bmp), in the exact folders given in Section 16, and reopen the MFD so the folders are rescanned.

Custom Pieces Show Magenta Boxes

The sprite background is not pure RGB(255, 0, 255) - even one unit off disables the transparency. Flood-fill the background with exact magenta.

The AI Takes a Long Time to Move

At Expert level, five to twenty seconds per move is by design - the engine extends its thinking in endgames and difficult positions. Choose a lower strength level for faster games.

Saved Game Won't Load

Confirm Config\ChessMFD\ChessMFD_saved_game.txt exists and has not been hand-edited into an invalid state. There is a single save slot; saving again overwrites it.

Getting Additional Help

Check Orbiter.log in your Orbiter root directory for detailed messages.

Search for "ChessMFD" entries, which contain diagnostic information.

Post your issue on Orbiter-Forum.com with the relevant log excerpts.

Include your Orbiter version and a description of what you were doing when the issue occurred.

18. Technical Overview

This section gives a layman's explanation of how ChessMFD works behind the scenes. It isn't necessary reading for normal use, but may be of interest to developers, troubleshooters, or the technically curious.

18.1 Architecture and Threading

Orbiter's main thread draws the MFD and handles all input. The moment it is the engine's turn, the search is handed to a dedicated worker thread, so even a twenty-second Expert think never affects the simulation's frame rate. The board you see, the live node counter, and the real-time evaluation are read from thread-safe state the worker publishes as it searches.

Shutdown is deliberately careful: if you switch MFD modes, change vessels, or close Orbiter while the engine is thinking, the search is signalled to abort and terminates within milliseconds - the interface never blocks waiting for a move that no longer matters. Book and puzzle files are likewise loaded on a background thread at startup.

18.2 The Chess Engine

The engine is an original, self-contained C++ implementation, built around a classical alpha-beta framework with modern refinements:

- Principal Variation Search with iterative deepening and aspiration windows
- A 262,144-entry transposition table with generation-based aging and mate-distance handling
- Quiescence search with full check evasions, static exchange evaluation (SEE), and delta pruning
- Null-move pruning (with zugzwang protection), late move reductions, killer moves, and history heuristics
- Make/unmake move execution with incrementally updated Zobrist hashing - no memory allocation anywhere in the search
- A tapered evaluation covering material, piece placement, pawn structure, passed pawns, mobility, king safety with pawn shields, and more
- Adaptive time management that budgets more thought for endgames and critical positions, and stops early when the best move is stable

On typical hardware the engine searches several hundred thousand positions per second, reaching depths of 8-12 plies in middlegames at Expert time settings - approximately 2000+ Elo in practical strength. Draw rules (repetition, fifty-move, insufficient material) are implemented in full, so results are always correct.

18.3 Books and Personality

The opening and endgame books are consulted before any search. Below Expert level, a personality layer sits on top of the engine: after the search finds the best move, the AI sometimes - with level-dependent probability - selects a slightly inferior but natural alternative, and paces its replies with a short human-like delay. This produces believable weaker opponents without crippling the underlying engine.

19. License Information

ChessMFD License

ChessMFD is released under the MIT License:

MIT License

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Third-Party Components

Orbiter Space Flight Simulator SDK. This module is built using the Orbiter SDK. Orbiter is copyright (c) 2000-2016 Martin Schweiger. The Orbiter SDK is provided for third-party development under terms specified in the Orbiter documentation.

XRSound (Optional). Where XRSound integration is used, XRSound is copyright (c) Douglas Beachy and is licensed separately. ChessMFD's XRSound integration is entirely optional - the module functions fully without it.

Microsoft Speech API (SAPI). Voice narration uses the Microsoft Speech API, part of the Windows operating system, used under Microsoft's standard terms for Windows application development.

Source Code

The complete source code for ChessMFD is included with this distribution. You are free to study it, modify it for your own use, distribute modified versions under the MIT license terms above, and use portions of it in your own projects with attribution.

Source files included:

ChessMFD.h / .cpp	MFD interface, all screen/input logic, AI threading
ChessEngine.h / .cpp	The complete chess engine (rules, search, evaluation)
ChessMFD.rc	Embedded resources (built-in board and piece artwork)
resource.h	Resource identifiers

Disclaimer

ChessMFD is provided "as-is" without warranty of any kind. The author is not responsible for damage to your system, loss of data, compatibility issues, performance problems, or any other issues arising from use of this software. Use at your own risk, and always back up important data.

20. Credits and Acknowledgments

ChessMFD was developed by Dimitris "dgatsoulis" Gatsoulis.

Special thanks to:

- Martin Schweiger, for creating Orbiter Space Flight Simulator
- The Orbiter community, for continued support and feedback
- Douglas Beachy, for XRSound
- Microsoft, for the Speech API

Contributing

The source code is included - feel free to modify and experiment.

Share your improvements on the Orbiter forums.

Contact the author through Orbiter-Forum for major enhancements.

Bug reports and feature requests are always welcome.

Thank you for using ChessMFD!

For support, visit the Orbiter-Forum at www.orbiter-forum.com

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