ChatGPT

Monitoring-Only Screening System Upgrade for War, Tech & Critical Materials Themes

Disclaimer – Monitoring Only, No Recommendations
This plan proposes quantitative filters and risk signals for a U.S.-listed stock/ETF universe related to defence/war demand, strategic technology build-out and critical materials. It is **not** investment advice. All thresholds and formulas are examples and should be calibrated by qualified professionals.

A. Institutional Tradability Gate

This gate filters out securities that are likely too illiquid, too short-dated or prone to execution problems. It draws on trading-desk conventions and regulatory guidance. Penny-stock risks are highlighted by FINRA: the 1992 risk disclosure defines a penny stock as a security priced below $5 that does not trade on a national exchange, noting that investors often cannot sell back to the dealer and may lose their investment [1]; therefore, these should be excluded. Low-volume stocks (≤1 000 shares/day) are difficult to trade and may be manipulated [2], so a minimum dollar-volume is required. High institutional traders often require ≥$20 million of average dollar volume per day and prefer ≥$80 million for large flows [3]; this guides liquidity thresholds. Average daily trading volume (ADTV) indicates how actively a stock trades and helps assess liquidity; higher ADTV makes it easier to enter/exit without large price impact [4]. A measure of illiquidity is the proportion of non-trading days (PNT) – the NBER study on OTC stocks shows higher PNT indicates higher illiquidity [5]. The Amihud illiquidity estimator uses the ratio of absolute return to dollar volume to measure price impact [6]. When bid–ask quotes are unavailable, the Corwin–Schultz high-low estimator derives spreads from daily high/low prices because high prices mostly reflect buy orders and lows reflect sell orders.

Eligibility parameters (default values may be adjusted by CLI arguments)

Parameter	Default	Allowed range	Rationale & source
Min ADV20$ (average dollar volume over past 20 trading days)	$20 M	≥$5 M	Institutions require liquidity; thresholds reflect institutional guidelines [3] and risk of low-volume stocks [2].
Min trading history	252 trading days (≈1 yr)	≥126 d	Enough data for 6- and 12-month returns, SMA200 and volatility [7]; shorter histories produce unreliable indicators.
Max price	user-specified (e.g., $10)	≥$1	Universe may be restricted to cheap names; incorporate price cap.

Parameter	Default	Allowed range	Rationale & source
Price floor	$5	≥$1	Exclude penny stocks; FINRA defines penny stocks < $5 and warns of illiquidity and inability to resell [1].
Zero-volume fraction (PNT)	< 5% of trading days in past 6 months	0–100%	High PNT signals illiquidity [5].
High-Low spread proxy	< 2% (2-day estimator)	0–10%	Derived from daily high/low prices; the Corwin–Schultz estimator uses high-low ratios to estimate bid–ask spreads.
Amihud illiquidity (avg(	return	÷dollar vol)*1e6)	< 0.5
Min days above SMA200	>30% over last 6 months	0–100%	Ensures long-term trend breadth; rising moving averages indicate up-trend [8].
Data quality	no gaps >3 consecutive days; returns/closes finite	—	Ensures reliability; missing data or abnormal spikes flagged.

B. Risk Flag Taxonomy (Red/Amber/Green)

Each security receives flags based on quantitative thresholds. *Red* flags disqualify eligibility; *Amber* flags impose score penalties; *Green* denotes acceptable risk.

1. **Extreme volatility** – Annualised volatility computed from daily returns (std × $\sqrt{252}$ [9]).
   • *Red*: ≥80%
   • *Amber*: 50–80%
   • *Green*: <50%
   High volatility indicates unstable prices.

2. **Deep drawdown** – Maximum drawdown (MDD) over past 6 months measures worst peak-to-trough decline [10].
   • *Red*: MDD ≤ −60%
   • *Amber*: −40% to −60%
   • *Green*: > −40%.

3. **Tail-risk exposure** – Worst 5-day return within last 6 months.
   • *Red*: worst return ≤ −20%
   • *Amber*: −15% to −20%
   • *Green*: > −15%.
   This is a simple tail risk measure; tail events can cause severe losses [11].

4. **Long-trend weakness** – Percent of days close > SMA200 (computed using 200-day moving average) [7].
   • *Red*: <20%
   • *Amber*: 20–40%
   • *Green*: >40%.

5. **Illiquidity** – Evaluate ADV20$ and PNT.
   • *Red*: ADV20$ < min threshold or PNT $\geq$10%
   • *Amber*: ADV20$ between min and 2× min, or PNT 5–10%
   • *Green*: otherwise.

6. **Frequent zero-volume** – Same as PNT but measured over trailing 3 months. Higher frequencies show persistent illiquidity; flagged as red if $\geq$10%.

7. **Spread-proxy risk** – High-low spread estimator (two-day).
   • *Red*: Spread >4%
   • *Amber*: 2–4%
   • *Green*: <2%.

8. **Coverage gaps** – Data gaps or fewer than 126 trading days of history; flagged *Red* if missing >10% of days, *Amber* if missing 2–10%.

9. **Theme classification uncertainty** – Low classification confidence (see §D). *Red* if no reliable classification; *Amber* if moderate confidence; *Green* if high confidence.

Flags influence scoring (§C): red flags typically exclude the security or impose strong penalties; amber flags subtract points; green flags have no penalty. The system logs all flags in the output CSV.

C. Risk-Adjusted Scoring Model

A composite score ranks eligible securities from 1 (lowest priority) to 10 (highest). The score consists of momentum, liquidity and risk components. We propose two variants:

1. Conservative / Quality-Biased Variant

Focuses on liquidity and downside protection; emphasises drawdowns and volatility penalties.

Score formula:

$$\text{Score} = 10 \times \Big(w_m \cdot M + w_l \cdot L - w_r \cdot R \Big)$$

where:

- **M (Momentum)** = normalized combination of 1-, 3-, 6- and 12-month total returns and SMA ratios (SMA20/50/200). A simple implementation:

$$M = 0.4\,z(r_{6m}) + 0.3\,z(r_{12m}) + 0.2\,z(\text{SMA20}/\text{SMA50}) + 0.1\,z(\text{SMA50}/\text{SMA200})$$

where $z(x)$ is the z-score relative to the eligible universe. The weighting emphasises intermediate-term momentum. Moving-average ratios reflect trend direction (rising MAs indicate up-trend [8]).

- **L (Liquidity)** = z-score of ADV20$; negative z-scores are capped at −2 to avoid rewarding extremely low liquidity.

- **R (Risk penalties)** = linear combination of volatility, MDD and tail risk:

$$R = 0.5\,z(\text{Vol}_{20D}) + 0.3\,z(|\text{MDD}_{6m}|) + 0.2\,z(|\text{Worst 5D return}|)$$

High volatility and drawdowns increase risk; z-scores are positive for above-average risk.

- **Weights**: For the conservative variant, $w_m = 0.35$, $w_l = 0.35$, $w_r = 0.30$. Liquidity and momentum are equally important; risk penalties strongly reduce the score.

Red flags subtract 3 points (e.g., a security with any red flag cannot exceed 7). Amber flags subtract 1 point each. Scores are clipped to the 1–10 range and bucketed into deciles.

2. Opportunistic / Momentum-Biased Variant

Suited for momentum-chasing strategies; emphasises price trends and tolerates higher volatility.

- **Weights**: $w_m = 0.55$, $w_l = 0.20$, $w_r = 0.25$. Momentum dominates; liquidity still matters but risk penalties are less heavy.

- Amber flags subtract 0.5 points; red flags subtract 2 points but do not automatically disqualify if liquidity is adequate.

Calibration Guidance

- **Backtest & cross-validation** (see §F) should be used to tune weights.
- Use z-score normalization to avoid scale issues.
- Ensure no look-ahead bias by using only data available at the ranking date.
- Evaluate stability across regimes; adjust weights or thresholds if scores are too sensitive to macro environment.
- Keep weights simple (two decimals) to facilitate implementation in PowerShell or Python.

D. Theme Classification Upgrade

The existing system likely relies on simple name/keyword heuristics. To improve thematic tagging while respecting licencing constraints, use multiple data sources and assign a confidence score.

Data sources and methods

1. **GICS or NAICS codes** – Many brokers and free data sources (e.g., NASDAQ symbol directory) provide sector/industry codes. Map the following:
2. *Defence/war*: Aerospace & Defence (GICS industry 20101020), Shipbuilding, national security primes (e.g., NAICS 3364).
3. *Strategic technology*: Semiconductors (GICS 4520), IT services (4510), AI, cybersecurity and robotics sub-industries.

4. *Critical materials/metals*: Metals & Mining (151040), Steel (151050), Chemical & Lithium producers, Rare Earths (NAICS 2122).

5. **ETF holdings cross-reference** – Create lists of tickers from defence ETFs (e.g., ITA, XAR), strategic tech ETFs (e.g., QQQ, AIQ), and metals ETFs (e.g., XME, LIT). If a security appears in one of these ETFs (weight >0), raise its theme score. Use free holdings files where licence allows.

6. **EDGAR 10-K segment analysis** – Download the most recent 10-K filings from EDGAR using Python; parse the business description and revenue segments for keywords ("defense contract," "DoD," "military," "semiconductor," "artificial intelligence," "lithium," "rare earth") and measure the proportion of revenue attributable to relevant segments. This provides an additional check but may be approximate.

7. **Weak supervision and ensemble scoring** – Assign binary indicators from each source (industry code match, ETF match, keyword match). The confidence score is the average of these indicators.

8. *High confidence* ($\geq$0.67): at least two independent sources agree.
9. *Moderate* (0.33–0.67): one source matches.
10. *Low* (<0.33): no reliable source; flagged as uncertain.

Failure modes

- **Diversified conglomerates** may have small defence divisions yet be coded as Aerospace & Defence; treat them with caution.
- **Ambiguous names** (e.g., "Metal Tech") may lead to false positives; rely on codes and filings rather than names alone.
- **ETF holdings** may lag or include non-theme exposures (e.g., aerospace suppliers).
- **Text extraction** may miss synonyms or misclassify, and small companies may not file full 10-Ks.

The classification should not drive buy decisions; it only determines which stocks fall into each theme for monitoring.

E. Regime Overlay & Historical Parallels

Macro variables influencing themes

Research indicates that macroeconomic variables affect sector performance differently [12]. Metals & Mining and Capital Markets show strong negative correlation with the U.S. dollar; a 1 % USD depreciation

can provide greater tailwinds for metals & mining than for capital markets [13]. Key variables and their rationale:

Variable (public source)	Influence	Example series (FRED code)
10-yr Treasury yield & slope	Proxy for monetary policy; higher yields increase discount rates and hurt long-duration (growth/tech) stocks [14] [15].	`DGS10` (10-yr yield); `T10Y2Y` (10-yr – 2-yr).
10-yr breakeven inflation	Measures market inflation expectations; high breakevens benefit commodities/metals; too high can hurt real returns; from FRED series `T10YIE`.	
USD index (DXY)	A strong USD hurts commodity prices; a weak USD aids metals & mining [13].	Use ICE USD index or FRED series `DTWEXBGS`.
WTI crude oil price	Proxy for energy costs; influences defence budgets and industrial production; high oil benefits energy-driven miners but may hurt consumers.	FRED series `DCOILWTICO`.
ISM manufacturing PMI & industrial production	Leading indicators of industrial demand; high PMI suggests strong demand for metals and tech equipment.	`NAPM`, `INDPRO`.
Credit spreads (BAA–AAA or corporate vs Treasury)	Wider spreads signal investor risk aversion and economic stress; credit spreads are among the best indicators of economic health and sentiment [16].	`BAA10Y` – `AAA10Y` or FRED series `BAMLH0A0HYM2`.
Volatility index (VIX)	High implied volatility signals market stress; tail events are more probable [11].	CBOE VIX series.

Regime detection methodology

1. **Data extraction** – Use Python to download daily or weekly values of the above series from FRED (free and public) and compute their 3-month Z-scores relative to a rolling 10-year history.
2. **Composite regime scores** – For each variable, classify into three states: high ($z > 1$), neutral ($-1 \leq z \leq 1$), or low ($z < -1$).
3. **Macro regime** – Combine states: e.g., *Tight money* (high yields, high USD, high credit spreads); *Loose money* (low yields, low spreads); *Commodities boom* (weak USD, high breakevens, high PMI).
4. **Historical parallels** – Compare with past mobilisation regimes:
5. *World War II mobilisation* (1940s): defence spending surge, inflation, and negative real rates; can guide risk tolerance.
6. *Cold War/Space Race* (1950s–60s): sustained defence R&D and high industrial production.
7. *1970s resource shocks*: commodity boom, high inflation, weak USD.
8. *1990s tech build-out*: falling rates, strong USD, digital infrastructure investment.
9. *2020s energy transition*: high metals demand, geopolitical tensions, aggressive tech investment.

Scenario sensitivity templates

Scenario	Observed macro state	Gate adjustments	Score adjustments	Theme emphasis
Tight Money / Strong USD	High yields & USD, low breakevens; credit spreads widening.	Increase min ADV20$ (e.g., from 20 M to 40 M); tighten volatility/ drawdown red flags; raise minimum trading history to 2 yrs.	Increase weight on liquidity & risk penalties (e.g., w_l=0.4, w_r=0.35); reduce momentum weight.	Focus on defence (government contracts can be counter-cyclical [17]); de-emphasise tech & metals.
Loose Money / Weak USD	Low yields, rising breakevens, weak USD; credit spreads narrowing.	Loosen liquidity gates (min ADV20$ 10 M); allow moderate volatility; relax PNT threshold (10%).	Increase momentum weight (e.g., w_m=0.6) and reduce risk penalties; allow higher tail risk.	Prioritise metals/ miners (benefit from weak USD [13]) and strategic tech (cheap funding [15]).
Commodity Boom / Inflation	High WTI & breakevens, weak USD, strong PMI.	Keep liquidity thresholds moderate; maintain price floor.	Add commodity-beta metric (e.g., correlation of returns with WTI) to momentum component; penalize high energy costs for tech.	Emphasise metals and energy transition plays; lower ranking for rate-sensitive tech.
Risk-Off / Crisis	Credit spreads and VIX spike; PMI falling.	Enforce strict gates; exclude high volatility or drawdown names; require high liquidity.	Increase risk penalties; apply harsher red flag penalties; down-weight momentum.	Focus on defence (historically resilient due to government contracts [17]); monitor for potential government support for strategic tech.

The model need not automatically reweight on regime detection; rather, the overlay informs risk managers when to tighten or loosen gates and adjust score weights in configuration files.

F. Backtest & Validation Plan (Monitoring-Only)

Minimum Viable Backtest

1. **Data** – Use the survivorship-biased universe from NASDAQ trader symbol directories at each historical date; join with Stooq OHLCV to compute features. Avoid look-ahead bias by using only data available up to the ranking date; when computing moving averages or volatility, use prior 200 and 20 days only.
2. **Walk-forward evaluation** – Recalculate scores at a monthly frequency (e.g., first trading day of each month) from 2010 to present. After forming deciles 1–10, record next-month total returns (not used in scoring).
3. **Metrics** – For each decile: average next-month return, hit rate (% of securities with positive relative return vs universe), maximum and median drawdown, annualised volatility and turnover (proportion of names replaced each month). Compare top decile vs equal-weighted universe.
4. **Robustness** – Split sample into macro regimes (as above); evaluate whether top-decile performance persists across regimes. Conduct subperiod tests (e.g., 2010–15 vs 2016–20 vs 2021–25).
5. **Leakage avoidance** – When computing classification features (e.g., ETF holdings), use only holdings data available as of the evaluation date. Do not assign high confidence to companies not yet listed. Use delisting data to remove delisted securities after they leave the universe.

Ideal Backtest

In addition to the minimum plan:

- Use CRSP or another high-quality dataset with survivorship-bias correction (if available) and incorporate corporate actions (splits/dividends) to compute total returns.
- Incorporate transaction costs using high-low spread estimator; evaluate net returns.
- Test out-of-sample weight calibration: use first half of history for calibration, second half for validation.
- Compare conservative vs opportunistic variants; test sensitivity to thresholds.
- Evaluate sector exposure and concentration; ensure diversified exposures within each theme.

Backtesting is solely for monitoring and validation; there is no trade execution.

G. Implementation Plan (PowerShell + Python)

Below is a high-level checklist to integrate the above upgrades into the local monitoring application. The system currently reads NASDAQ symbol files, loads Stooq OHLCV data, computes basic features and writes `features_*.csv`, `scored_*.csv` and `eligible_*.csv`. Enhancements should be modular to allow toggling via configuration file or CLI.

1. Parameterization

- **Config file** (YAML/JSON) storing default thresholds (ADV20$, price floor, price cap, PNT threshold, high-low spread threshold, Amihud threshold, min history), scoring weights (two variants), and regime adjustments.

- **CLI arguments** override config values; e.g., `--min-adv`, `--price-cap`, `--variant=conservative/opportunistic`, `--regime-adjust`.
- Add an option `--date` to run on historical dates for backtests.

2. Data Ingestion

- **NASDAQ directory** – Continue to download symbol lists via PowerShell; unify tickers.
- **Stooq OHLCV** – Extend script to calculate new features:
- **High-Low spread**: implement Corwin–Schultz estimator (requires two days of highs and lows) from high/low columns.
- **Amihud illiquidity**: compute `|return| / dollar_volume * 1e6` and average over the past 20 days [6].
- **Zero-volume days**: count days with zero volume (volume == 0) in the last 3, 6 and 12 months; compute PNT.
- **Moving averages**: SMA20, SMA50, SMA200 and their ratios; percent days above SMA200.
- **Volatility & downside vol**: daily return standard deviation × $\sqrt{252}$ [9]; compute downside volatility using negative returns only.
- **Worst-5D return**: rolling 5-day return; record the minimum over 6 months.
- **Max drawdown**: compute cumulative returns; find max peak-to-trough decline [10].
- **ETF holdings & classification** – Use a Python script to download holdings CSVs (where available) and store mapping; parse 10-K filings using EDGAR APIs or local downloads; compute theme indicators and confidence scores.
- Save extended features to `features_ext_DATE.csv`.

3. Eligibility & Flagging

- Create a function to evaluate the tradability gate using parameters in the config. Output a boolean `eligible` and individual flags. Write `eligible_ext_DATE.csv` containing only securities passing red-flag rules but include flags for further analysis.

4. Scoring

- Implement the scoring formula as per §C; normalise features with z-scores computed over the eligible universe. Provide two functions for the conservative and opportunistic variants. Apply penalties for red/amber flags. Write `scored_ext_DATE.csv` with raw scores, decile ranking and variant name.

5. Regime Detection Module

- Fetch macro series from FRED (via `pandas_datareader`) or local cache; compute 3-month z-scores and classify states.
- Optionally adjust gating thresholds and scoring weights based on the detected regime using the playbook (§E).
- Store regime state and macro values in a file `regime_DATE.json` or `csv`.

6. Report Generation

- Use Python to assemble a Markdown report summarizing:
- Top-ranked securities (e.g., top 10 names per theme) with scores and flags.

- Distribution of flags (counts of red/amber/green).
- Theme breakdown (number of securities per theme and confidence level).
- Current macro regime state and variables (10-yr yield, USD, breakevens, WTI, credit spreads).
- Any notable changes from previous runs.
- Write the report to `report_DATE.md`; convert to HTML if needed. The script should be called at the end of the PowerShell pipeline.

7. Logging & Caching

- Implement logging (to file and console) at various verbosity levels.
- Cache downloaded data (symbol lists, macro series, ETF holdings, filings) to avoid repeated downloads.
- Provide error handling for missing data and API rate limits; fall back to last cached values.

8. Optional Use of Codex

The user has access to a coding AI agent ("Codex") to automate heavy coding tasks. If complex modules (e.g., high-low estimator or EDGAR parser) are beyond manual scripting, Codex can generate Python classes or PowerShell functions from the specifications above. The code can then be reviewed and integrated into the repository. Use of Codex is optional and should follow the same monitoring-only guidelines.

Conclusion

This upgrade plan provides a comprehensive, evidence-backed framework for screening U.S.-listed stocks and ETFs associated with defence/war, strategic technology, and critical materials. By imposing robust tradability gates, quantifying multiple dimensions of risk, enhancing thematic classification, overlaying macro regimes, and outlining rigorous backtest procedures, the system aims to mirror professional risk-management practice while remaining implementable on a local Windows PowerShell + Python stack. Adjusting parameters and weights through ongoing validation and macro-regime awareness will ensure that the monitoring system stays aligned with evolving market conditions.

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