**Portfolio construction – use page 5 of presentation**

**1. Models:**

**Trend strategy:** 45% risk allocation

* **Description:** Persistent behavior in the markets can be exploited by quantitative trend-following models which chase price action. The critical elements to understand are how trends start, how they end, and how to find the "signal" in the presence of other "noise" factors. The trend-following component of the investment approach will be derived from signal processing methods, which are most commonly used in electrical engineering. The key trade-off in digital filter design is the balance between edge correction and delay. In layperson's terms, the surer you need to be that a trend has started, the later you will enter the trade. Since the Partnership will aim to exploit factors in two different time frames, the short- and long-term, the Partnership will need to employ distinct sets of filters. Short-term models are biased toward action and intended to react quickly to the beginning and ending of a short-term trend. In long-term models timing is less critical and the strategy will attempt to eliminate noise at the expense of missing the beginning of a new long-term trend.
* **Key differentiating factor(s) vs. competitors:** First, the use of clusters rather than individual markets, second, is the use of “Feature variables” (a machine learning term) to inform the models of profitability, and third, portfolio construction which protects the portfolio from becoming overly exposed to one market or sector. Examples of feature variables: 1) A Low frequency asset, meaning smooth price action, is seen as more likely to succeed for trend following and will receive an above average weight, 2) An analysis of the implied volatility curve (the “skew”) of a market’s options market, when implied volatility of calls is greater than implied volatility of puts it is seen as favorable for long trend following position, but as a trend matures implied volatility of puts increases which reduces the signal strength, 3) An analysis of the trading cost of an asset, comparing the actual bid-ask spread to the expected bid-ask spread, for trend following if trading cost is seen as high then short-term sensitivity is reduced and holding period is extended to avoid offsetting profits with trading costs
* **Number of models in strategy (as of today):** 10
* **How various models are differentiated:** Moving averages and breakouts using short, medium and long-term models. The overall average is 12 “flips” (shifts from long to short, or short to long) per year, or 1 “flip” per month. Flips range from 2 weeks to 2 months.
* **Market sectors traded:** Ags/Softs, Energy, FX, Interest Rates
* **Market sectors NOT traded:** Equities (though expected to be added in next update)

**Carry / Roll Yield:** 25% risk allocation

* **Description:** ASK RYAN ABOUT PAGE 5 – ARE RATES TRADED?
  + The Carry strategy prefers a higher frequency (less smooth price action) than trend following
  + Currency trades done specifically to capture yield differentials between countries are known as carry trades. As with any forward currency position, there is exposure to volatility in the spot market as well as volatility in interest rate differentials. The Partnership intends to limit the duration of its trades to less than twelve months in attempt to limit its interest rate risk. The Partnership will focus on the risk/reward relationship between interest rate exposure and the resulting spot market exposure. The Partnership will use quantitative models to design trades that aim to exploit this relationship. Also critical to the Partnership’s investment approach will be a battery of quantitative methods for estimating future spot market volatility.
  + Future delivery of physical commodities will trade at a discount or premium to the spot price, based on supply/demand factors and storage costs. Carry strategies seek to go long markets in “backwardation,” and short markets in “contango.” Backwardation means the future price is lower than current spot, and contango means the future price is higher than current spot. The strategy is profitable when future rates converge to spot rates. The Partnership will focus on the risk/reward relationship between convergence yield and the resulting underlying market exposure. The Partnership will use quantitative models to design trades that aim to exploit this relationship.
* **Key differentiating factor(s) vs. competitors:** Critical to the Carry strategy is looking at estimated volatility over different windows to avoid remaining in losing trades
* **Number of models in strategy (as of today):** One model
* **How various models are differentiated:** 8 different est of risk – 3 GARCH, 5 Frequency waves – with the signal coming from the average of the 8
* **Market sectors traded:** FX, Ags/softs, Energy
* **Market sectors NOT traded:** Equities and Interest Rates
* **Holding period:** Average 3 to 6 months, but can extended to longer than 1 year

**Relative Value / Mean Reversion:** 20% risk allocation

* **Description:** Strategies with inverse reaction to price action (often act inversely to trend).
  + Fair Value – **FX only strategy** – The Fair Value model is based off of the theory of relative purchasing power parity where inflation rate differentials between countries drive foreign exchange rates. For example, if Country A has 10% annual inflation while country B has no inflation, one would expect their exchange rate to move 10% per year to adjust for the changing rate of purchasing power in the two countries. This model will calculate an equilibrium price and short when above and go long when below. Fair Value modeling will act as a balancing force to the Partnership’s carry and trend models. Note that both carry and trend are self-reinforcing factors, while Fair Value is a mean-reverting factor. When carry, trend, or a combination of the two forces pushes exchange rates far away from their equilibrium level, the Fair Value model may have a bigger influence in the Partnership’s overall portfolio, thereby lessening the program’s risk if a reversal in trend or carry does occur.
  + Mean Reversion – **FX only strategy** – Mean Reversion strategies attempt to profit from short-term volatility. It is the inverse of the trend strategy – rather than eliminate noise to trade the signal, we are attempting to eliminate signal and trade the noise. We exploit noise explicitly by taking short term positions (1-4 days) against recent price action.
  + Short Volatility (through options) – **Ags/softs, Energy, Interest rates** – Mean Reversion strategies attempt to profit from short-term volatility. It is the inverse of the trend strategy – rather than eliminate noise to trade the signal, we are attempting to eliminate signal and trade the noise. We exploit noise explicitly by selling short-dated options that will be profitable if prices stay in a range (i.e. price action dominated by noise). Trades are structured as short straddles. This is the only strategy that uses that uses options.
  + Sentiment – **Ags/softs, Energy** – Uses data from the Commitments of Traders report (a weekly CFTC report which provides the open interest in futures markets) to evaluate whether a market is over long or over short relative to the market’s historical characteristics and is there a historical bias or is it changing over time.
* **Key differentiating factor(s) vs. competitors:** These strategies are designed specifically to interact with the program’s trend and carry strategies, which may differentiate them for similar strategies used by competitors.
* **Number of sub-models in EACH strategy (as of today):** 
  + Fair Value – **one**
  + Mean Reversion – **two**
  + Short Volatility – **one**
  + Sentiment – **one**

**Pattern Recognition:** 10% risk allocation

* **Description:** The pattern recognition strategy seeks to fill the void between trend following and mean reversion strategies and looks take advantage of trend and consolidation patterns over a 1-2 week holding period. The 10% risk allocation can alternatively be thought of as 5% trend and 5% mean reversion. While trend is looking for low frequency assets, pattern recognition is looking for high frequency assets with price reversals and can take the opposite position. Patter recognition uses the same feature variables as the trend following model, but unlike the trend following strategy where the model dictates the direction of the trade and the feature variable determine the size of the position, feature variables can influence the direction of trades within the pattern recognition model. Shorter than the shortest trend following model.
* **Number of models in strategy (as of today):** one
* **Market sectors traded: All markets** (note: FX reported within FX trend as of today)

**2. Trade allocation/sizing:**

**How are trade sizes determined?**

~~The simplest way to construct a portfolio is to take all potential trades and allocate an equal share of capital to each.~~ The problem with this “maximum entropy” approach is that it ignores available information, including that: (i) some trades have stronger forecasts than others; (ii) some trades are riskier than others; and (iii) trades are related to each other in ways that can augment or degrade overall diversification. None of this information is known, but it can be estimated.

The Partnership’s approach to portfolio construction will be to "build locally, evaluate globally." As discussed earlier, the Partnership intends to make localized forecasts on small clusters of assets. Trade size will be adjusted by the forecast strength (which ranges from -100 to +100) and estimated volatility of each cluster. The clusters themselves will be built with estimates of correlation between the component assets. Beyond that, the Partnership intends to employ the maximum entropy approach of simply combining all of the candidate trades to form the Partnership’s portfolio. The Partnership’s intended approach offers the complexity of an optimized solution with a substantially reduced exposure to estimation error.

Each cluster typically represents 10 bps of risk, this level of risk remains small as hundreds of clusters of utilized at any given time by the program.

Feature variables = filters. The program also uses machine learning to take signals from implied volatility and futures curves. The machine learning tools help to overweight or underweight certain trades. Filters are used to size trades, but not to select trades. An example of a filter would be a volatility filter for carry (low/declining vol is better).

**What is the maximum margin to equity and what is the average level?** No systematic max m/e. FX forwards represent a challenge for traditional m/e calculations.

**3. How are trades exited?**

The program does not use stop loss limits, profit targets or time based rules to exit trades.

Trades are exited using the same process as they were entered. Models’ signal strength will range from -100 to +100, with positive levels indicating a long position and negative levels indicating a short position. Trades are entered and exited as the signal strength cross zero.

**4. Trade Execution Process:**

ROW runs its models once per day, at a time when all the markets we trade are open and liquid. Trade reports are generated at 7:30 am ET for FX and 10:30 am ET for Futures. Jeff has the flexibility to trade the system’s signals throughout the day, not just at the open and close – so he can add value through timing trades within the day. Jeff typically trades within an hour of getting the reports.

The portfolio manager may take exceptions of up to 20% of the size of any given position. The Investment Committee (Jeff Weiser and Ryan O’Grady) can reduce risk further in exceptional situations. All such deviations to the system are monitored, and their performance impact recorded and reviewed. Such deviations occur approximately 5% of the time and are typically the result of the portfolio manager delaying implementation of the program’s desired trade. As the models adjust the position in the coming days the exception can be eliminated by taking no action as the model moves to the position. Should the model move against the position, the portfolio manager would trade to eliminate the deviation. Such deviations are typically done to reduce risk within the portfolio.

**5. Research process and Current research efforts:**

All elements of the investment process are considered to be in development at all times. Part of the research process is to augment existing systems as well as develop new systems. Approximately equal time is focused on developing new trading systems and further refining the existing trading systems.

The next update to the program will broadly trade equities and metals as techniques used to forecast signals in these markets have created/improved. No additional equity markets will be added to the program, metals are not currently traded so Gold, Silver and Copper will be added to the program. This update is expected to be implemented by year end. The new version with equity and metals included is estimated to have a 0.96 correlated with previous version.

The CIO will perform a review of the “check it” report which compares actual positions in relation to the desired positions by the model.

**6. Risk Management:**

The first consideration is the desired output of the Partnership’s portfolio construction process.

1) The Partnership will work from the bottom up, starting at the individual asset exposure level (single markets, not clusters). For each asset, the Partnership will have strict concentration limits that will vary according to the General Partner’s qualitative view of liquidity. The program will systematically redistribute risk away from trades that put the Partnership over concentration limits and toward trades that have room under the limit. The program seeks to redistribute risk as evenly as possible in order to maintain a balanced portfolio.

2) Risk limits on individual clusters - to avoid excessive exposure when several models become aligned.

3) As part of the portfolio construction process the program will systematically limit the risk of model strategies using VAR based limits (and use the weights on page 5 of presentation?).

4) The Partnership will also have a limit on total leverage and will be constrained by margin requirements.

After considering the desired output of the portfolio construction process, the “Loss Mitigation Model” systematically isolates losing positions and reduces them. The LM model decomposes the portfolio into individual assets (single markets, not clusters), and tracks performance over the previous 2 to 4 weeks. If there is a particular asset is generating losses beyond a threshold rate, the Loss Mitigation Model reduces exposure to that trade. The LM model will make no adjustments approximately 85% of the time.

Next is an a evaluation of risk at the portfolio level through volatility estimated from a proprietary Monte Carlo analysis as well as short, medium and long-term GARCH volatility estimates.

* The Partnership’s risk models will use weighted past observations to create a forecast of future portfolio volatility. The weights will be balanced differently in the different models, as they will be tailored to be optimal in different volatility regimes. For example, in September and October 2008, the optimal risk model was one that considered only recent data in its estimate. Rather than try to guess what regime the Partnership will be in, the Partnership will calculate risk using all of its volatility models and then use the highest (worst-case scenario) in the Partnership’s risk targeting.
* The Partnership will have a specific risk target that will be managed by a series of quantitative volatility models that will operate at the portfolio level. When we hit overall VAR limits on risk in a given asset class/strategy/portfolio, all positions in the affected silo would be reduced.

The final stage of our risk management is human oversight – if we judge that our empirical risk estimates are not accurately representing the true risk in the market, we have the ability to reduce positions at the Investment Committee level. The final stage of risk management is human oversight. Jeff Weiser is responsible for risk management and has the authority to “selectively reduce risk during market events/crises exogenous to the model’s field of view.” Jeff said this comes into play 4-6 times per year. Discretion is only used after the systematic program creates the portfolio. When ROW uses discretion it is a reflection on their opinion of the quality of the data going into the models rather than taking an opinion in a market, and is implemented with the team feels there is greater risk within the program from not intervening. Discretion is usually associated with reducing risk and/or losing positions.

* If estimated annualized volatility exceeds 20% the investment committee will discuss intervening and will decompose risk to identify outlier markets rather than reduce the entire portfolio proportionally, which would not be cost efficient.

**7. Ideal environment for strategy / Poor environment for strategy:**

* Ideal – 2008 scenario, Good – sustainable trends (given weight to TF strategy)
* Poor - Our worst experiences tend to be sudden trend reversals. These events do not have a significant impact on our trading methodology, as trend reversals are part of how time series behave. We do use them to enhance our risk management and reporting systems.

**8. Trade examples:** – Ryan will provide

* Show combined cluster chart – noting the timing of entry and exit – show periods before and after exit to show timing of trade and amount of “give back”
* Need successful “trades” and an unsuccessful “trades”
  + One of each - trend and carry
* Commentary needed for trade examples (bullet points, not paragraphs)

**9. Please provide gross daily returns since inception.** – Ryan will provide

**10. Please provide monthly contribution by sector if possible.** – Ryan will provide

**11. Please provide a breakdown of the 9/30/14 firm AUM by investor type.** – Ryan will provide

* Pension, FoF, Family Office, HNW, Internal capital

**12. Confirm who is currently Chief Compliance Officer.**

Ryan is currently the firm’s CCO, but Laurie Pisano will be taking over this role eventually, she is currently planning on taking the series 3 exam.

**13. Names of employees that have left the firm.**

Amin Shamei (analyst) and Sladja Carton (IR/marketing)

**14. Confirm Key Systems**

* In addition to proprietary research platform, signal generator and order management systems
* Matlab = central programing language
* CQG = for futures data
* Bloomberg = for FX and fundamental data

**15. Confirm that the auditor, brokers and administrator relationships date since inception, also confirm the date that legal counsel change.** – Ryan will provide

**16. Confirm how forwards are priced (futures all exchange traded).** – Ryan will provide