## Growth and Genetic Selection of a Vertically Integrated Beef Enterprise in Russia — Phil George

Miratorg Agribusiness Holding is a privately held food company based in Moscow, Russia started in 1995 owned by identical twin brothers. The brothers and their vice president are very involved in day to day management of the company. Their management style and decision making is very quantitative as they are trained as engineers and physicists.

Miratorg began as a trading company in 1995 by importing whey from Poland when food was very scarce in Russia after the breakup of the Soviet Union. Later, they added pork and poultry meat to their imports and set up a distribution network in European Russia. They then began adding value to their imported products thru further processing and repackaging. After 2000, the Russian government offered strong subsidies to encourage meat and dairy products to be produced in Russia. Miratorg began pork production in 2005 with a European model in the Belgorod Region.

The Angus project began in 2011 and the broiler project in 2012. They began establishing retail outlets all cities greater than 1M population in 2015. The prime lamb project was launched in 2017 with the establishment of the first sheep farm in the Kursk Region. It's an accelerated lambing project that will produce 1.5 million lambs per year by 2028.

Today, Miratorg is completely vertically integrated in pork, broiler, beef cattle and lamb production. It has 2 pork plants, a beef plant, a poultry plant, a poultry feed mill, 3 pork feed mills, a soybean processing plant, a tannery, a pet food plant, a rendering plant, a bacon plant, 20 "burger" restaurants in Moscow, a "flag-ship" restaurant (No Fish) restaurant in Moscow and 150 retail stores It controls nearly 3 million acres and a large agronomy division that produces 95% of the grain and forage for all species. In 2021, it planted and harvested 500,000 acres of corn (as dry corn, high moisture corn or corn silage), 250,000 acres of soybeans and 250,000 acres of wheat or barley. It also has a 7,000 acre, 54 Valley center pivot property that produces fresh carrots, potatoes and beets for its retail outlets.

Most Miratorg products are consumed domestically but the company does export meat and meat products to the other CIS countries, Saudi Arabia, the UAE (Dubai & Abi Dabi), Hong Kong, China, Japan and Brazil.

### Beef Cattle Project

Lynna and I arrived in Russia January 25, 2011. At that time, there were about 15-20 Russian employees and about 25,000 acres of unfenced raw land in the Bryansk Region near Trubchevsk. About 70 Americans and 3 Australians were recruited to train Russians over the next 5 years. The land team began acquiring 2,500 acres per week in 2011 but increased to 5,000-6,000 acres per week by 2016.

One hundred twenty-five thousand (125,000) commercial Angus heifers were imported from the US and Australia (50/50) in 2011, 2012, 2013 and 2014. Most of the US heifers were purchased from ranches in Montana, the Dakotas, Nebraska, Wyoming, Idaho and Oregon. Most Australian heifers were purchased from properties in Victoria, South Australia and New South Wales. All heifers were purchased from their original owners and quarantined before export.

All the US heifers were transported to and quarantined near Garden City, Kansas. Heifers were quarantined from 45 to 120 days, depending on their scheduling for export. All heifer shipments were loaded on the vessel in Galveston. The voyage from Galveston took 18-21 days depending on the Russian port of importation, Ust-Luga (near St. Petersburg and Baltic Sea port) or Novorossiysk (Black Sea port). Shipments from the US were typically 4,000 head per shipment. Heifers were allowed a 1.5-1.7 m2 (16-18 ft2) per head on the vessel.

The Australian heifers were quarantined near Portland and Warnabool, Victoria, Deniliquin, New South Wales, Mt. Gambier, South Australia and Freemantle, Western Australia. They were loaded on vessels at Portland, Victoria and Freemantle, Western Australia. Voyages typically took 30 days from Australia, crossing the Indian Ocean, passing through the Suez Canal, the Mediterranean Sea and through the Bosphorus Strait in Turkey into the Black Sea and off loaded at the port of Novorossiysk.

Two thousand registered Angus heifers were imported from the US and Australia to comprise the seed stock herd. About 7,000 registered Angus yearling bulls were purchased from 40 different breeders in the US. About 1,250 registered Angus bulls were purchased from Australian breeders. All bulls had to have CED, BW, YW, CW, Marbling and REA EPDs in the top 50% of the breed. Many ranked in the top 30th percentile of those traits.

About 500 Quarter Horses were also imported from the US to work the cattle along with 500 Western saddles. In the beginning, no Russians had experience saddling and riding or roping. All cattle on the farms are moved, gathered, checked on a horse today.

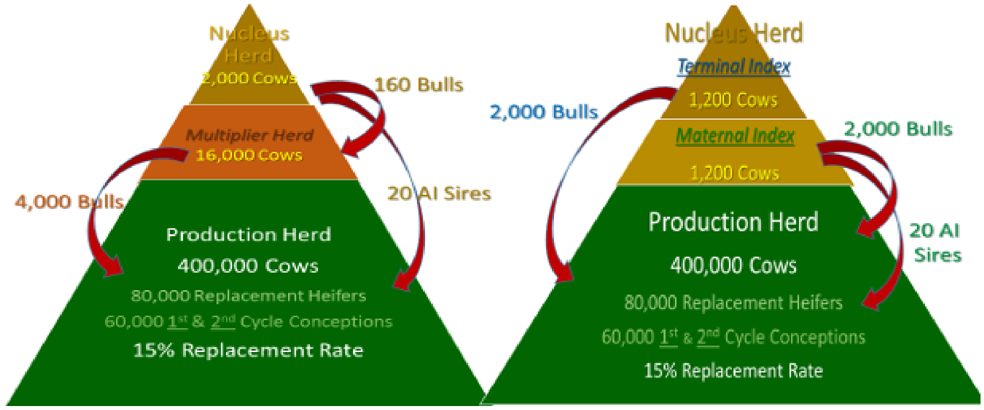
The company currently maintains 100 cow/calf production farms, 50 replacement heifer development farms and weaned steer backgrounding and grazing farms, 3 feedlots with a one-time capacity of 225,000 head and 1 beef plant with a 100 head/hour chain speed and an annual processing capacity of 500,000 head. Farms are typically 12,500 to 18,000 acres in size and have 25 employees each.

## Feeder Cattle Shipments

Fifty thousand feeder cattle (600 to 950 lbs.) were imported from Australia each year over 5 years to augment the company's production until it could domestically fulfill the plant's capacity. Seventy percent plus of the steers were Angus with the balance being black baldies, Hereford or other English crosses.

The steers were purchased in Australia's late spring or summer, quarantined and then arrived in Russia from December thru May. Over half arrived in the heart of the Russian winter when temperatures were 0oF to -25oF. They were completely acclimated to Australian summer conditions with no hair and no time to acclimate on the voyage as temperatures were hot to moderate until they entered the last day of their voyage crossing the Black Sea. They were deeply bedded in straw (2-3 ft deep) and fed a good corn silage ration on arrival. Death loss the first 45 days after arrival averaged 2.1% with the worst shipment reaching 3.5% death loss. Morbidity was a normal 5%. Dry matter intake was very high with 1 shipment reaching a DM intake of 3.45% one month after arrival in -25oF to -30oF weather.

**Figure 1**




## Genetic Improvement Strategy

Specific targets have been set for the most economically important traits in the production herd. Technologies of IVF, sex sorted semen, genomics and the GrowSafe@ System are employed to achieve these targets within 20 years. Once the genetic engine is moving on track, $6 million USD will be added to the bottom line each year with a projection of $120 million USD each year after 20 years of genetic improvement.

Four thousand bulls and 60,000 bred heifers are needed as replacement stock in the production herds each year. Two different strategies for bull and replacement heifer production were evaluated: 1) Nucleus herd with a large multiplier herd using natural service and 2) Nulcleus herd with no multiplier herd.

The evaluation is based on the following equation (Richard Bourdon, 1999)

$$\Delta = (r \times i \times \sigma) / L$$

$\Delta$ = rate of genetic change

r = accuracy

i = intensity

$\sigma$ = standard deviation of the traits

L = generation interval length

The genetic progress using the multiplier herd strategy was much slower. None of the targets for the economically important traits would be achieved within the 20 year timeline. Many traits would require 50 or more years to acheive their targets. Thus, the multiplier herd strategy was rejected and the strategy was adopted whereby bulls for the production herd are produced directly from the nucleus herd. See Figure 1.

In the multiplier model, most of the 4,000 bulls are produced from the multiplier herd which relies on natural service. In the non-multiplier model, separate terminal and maternal lines were established within the nucleus herd. Two thousand bulls each are produced from the nucleus terminal and maternal lines, respectively.

Animals within the nucleus herd were then assigned to terminal and maternal herds using genomic EPDs. PCA Analysis of the genotypes and K Cluster Evaluation identified 3 different clusters within the nucleus herd. One of the clusters had 3 different subsets. Subsequently, those within the maternal herd were assigned to 4 different maternal lines based on the K Clustern analysis. Top indexing bulls and heifers within the terminal line and the respective maternal lines are retained within the respective lines. Matings to limit inbreeding within the terminal and maternal lines are base on gemonics rather than pedigree evaluation.

The produciton farms were equally assigned as terminal or maternal farms, i.e., 200,000 cows within terminal farms and 200,000 cows wtihin maternal farms. Terminal farms receive bulls from the nucleus terminal line. All calves produced from the terminal farms are destined for the feedlot and the plant. Maternal farms recieve bulls from the respective maternal lines (1, 2, 3, 4). All steers and cull heifers from the maternal farms are destined for the feedlot and plant. Replacment heifers are retained from the maternal farms to provide replacements for the maternal and terminal farms.

Eighty thousand replacment heifers from the production farms are synchronized and AIed each year using the 7-Day CIDR and 14-Day CIDR Fixed-Time AI protocols. The two protocols have different post prostaglandin injection time intervals before fixed time AI so it allows groups to be scheduled for insemination each day at 7 am, 10 am, 1 pm and 4 pm on the same farm.

Genomic data, pedigree information and phenotypic data are all analyzed using single step methodology to provide genomic EPDs and a ranking by the Terminal or Maternal $index. The highest ranking heifers from the respective maternal farms are retained as replacments. They must weigh a minimum of 700 lbs and undergo a final phenotypic evaluation to confirm proper development and structure before entering the synchronization protocol.

The primary economically important traits in the Terminal $Index are carcass value (carcass weight and marbling) and Efficiency. Our strategy for improving efficiency is not to reduce feed intake but instead to simultaneously select for Residual Feed

Intake and Post-Weaning Average Daily Gain. Longevity in bulls, serving capacity and immune competence and resilience are lesser components of the terminal index.

A Breeding Soundness Examination is conducted on all yearling bulls and then on every older bull every year until he is culled. Besides, semen motility and morphology, the bull's weight, foots score and reproductive tract abnormalities are reported at this time. We expect to identify genotypes that are early culls verses those with long productive lives so we can skew our selection favorably.

The primary economically important traits in the Maternal $index are female fertility, longevity and efficiency. Phenotypic data contributing to the fertility EPD includes heifer, 1st calf heifer and mature cow pregnancy data. The heifer data is reported as AI, bull bred or open. About 20,000 records of the mature cow data is also reported as 1st cycle, pregnant and open.

What about crossbreeding? Crossbreeing should improve calf viability and reduce morbility and mortality in the birth to weaning phase, growing phase and finishing phase. It should also improve fertity in the females and perhaps feedlot feed efficiency. There could also be complimentary trait benefits in larger rib eyes and leaner carcasses.

Bulls of non-Angus breeds from US AI studs that qualified for export to Russia were evaluated as maternal or terminal sires. EPDs of six Hereford bulls and six Simmental or SimAngus bulls were adjusted to an Angus base using USDA=MARC's across breed adjustments. When compared to the maternal Angus sires, the Hereford bulls on average were substantially poorer in all the traits compared. The Simmental or SimAngus sires had better REA, similar WW and Milk EPDs compared to the maternal Angus but substantially bigger BW and poorer YW and Marbling EPDs. Crossbreeing experiments are planned to evaluate its maternal benefits.

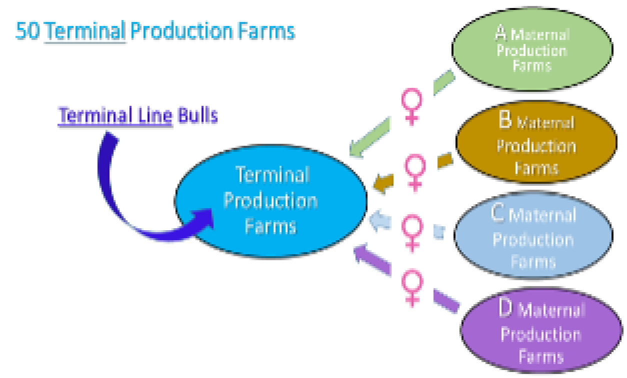
EPDs of six Charolais, six Limousin and six termnal Simmental or SimAgus bulls were adjusted to an Angus base using the same across breed EPDs and compared to terminal Angus sires. The non Angus bulls on average had bigger REA EPDs and were leaner but had much bigger BW EPDs and much poorer Carcass Weight and Marbling EPDs. The company concluded that using a Terminal Line Angus was much preferred to crossbreeding.

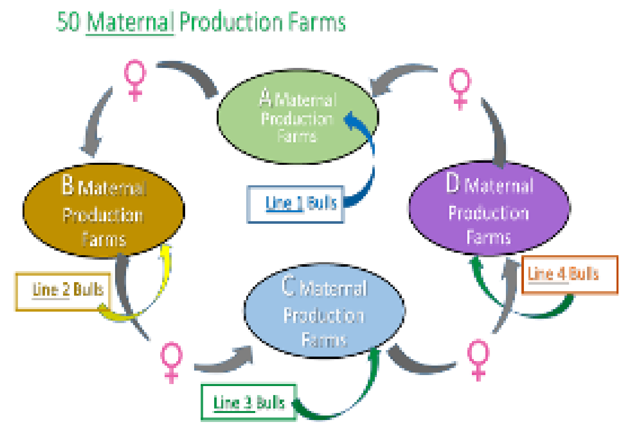
## Summary. What have we learned?

1. Cattle are extremely resilient and adaptable to severe cold weather challenges if they are fed and bedded well. Steers shipped from Australia's summer and arriving in Russia's winter endured temperatures on arrival of 0oF or even -25oF with a 2-3% death loss the first 45 days after arrival.

2. Genomically-enhanced EPDs are extremely reliable in selection. Dystocia was 1% or less on US and Australian heifers using US or Australian bulls ranking in the top 50th EPD percentile for Calving Ease Direct and BW. Steers sired by US or Australian bulls ranking in the top 50th EPD percentile for Marbling graded 30% Prime or better.

3. Reproductive technologies can be successfully implemented on a large scale. Fifty thousand plus replacement heifers have been synchronized and artificially inseminated for the last 8 years consistently achieving AI conceptions rates over 50% and




final conception rates of 90%. Four hundred embryos were produced daily using IVF methods and achieving embryo conception rates of 40%+. Thirty thousand embryos are produced and implanted annually using IVF methods. Sex sorted semen collected and used the same day (fresh) can achieve conception rates equal to frozen conventional semen.

4. Substantial investments were made in a genomics laboratory, semen sorting laboratory, facilities and laboratory to conduct IVF on a large scale and a large scale system to measure individual feed intake and efficiency. All of these technologies will drive the genetic progress in the cattle project and have a payback of 5 years of less once the genetic engine pushes forward.

5. There is great opportunity for genetic progress in beef cattle in identifying embryonic lethals, improving efficiency, fertility, serving capacity, longevity and immune system competence and resilience.