Australian Securities Exchange & Media Announcement

Clean TeQ Holdings Limited (ASX: CLQ)

18 November 2016

Scandium Marketing Update for the Global Transport Sector

Further to the ASX release of 3 March, 2016, Clean TeQ Holdings Limited (**Clean TeQ** or **Company**) is pleased to provide an update to the market in respect of the Company's scandium marketing activities over the last 6 months.

Scandium Marketing & Offtake Strategy

The Scandium Feasibility Study[1] and subsequent Nickel & Cobalt Pre-Feasibility Study[2] have demonstrated Syerston's potential to deliver large volumes of scandium oxide at low cost. The combination of reliable long-term supply and more competitive pricing is attracting considerable interest, especially from the global transport sector.

While the solid oxide fuel cell industry has been the dominant consumer of scandium in recent years, scandium's greatest value lies in the functional properties it imparts as an alloy in aluminium. Aluminium-scandium (AlSc) alloys represent one of the largest untapped opportunities for delivering lightweighting solutions to the global transport sector.

Growing transport sector interest in AlSc alloys arises from:

- Legislation setting tougher fuel efficiency targets and CO_2 limits globally;
- Aluminium's comparative benefits as a strategic lightweighting material; and
- Scandium's potent strengthening effect in a broad range of aluminium alloys.

Clean TeQ's AlSc market development efforts have focused on identifying applications where the finished component can be both better and lower cost with scandium inside. The higher input cost of metal containing scandium must be offset by lower component weight and reduced component manufacturing costs. This is achieved with an AlSc alloy that is stronger and easier to work with.

Major aluminium players and leading-edge transport sector companies are aware of the lightweighting opportunities that AlSc alloys offer. In fact, many of the original Al-Sc alloys were first developed in the 1960s, specifically for aerospace use. Adoption has been held back, however, by availability and affordability. As one of the highest-grade sources of naturally occurring scandium in the world, Syerston can transform value in use considerations across the entire global aluminium value chain.

Syerston will make quality scandium raw materials reliably available in commercially useful quantities and at much lower prices. To further improve the value proposition of AlSc alloys, Clean TeQ is collaborating with partners to optimise the scandium content. Compositions that deliver the full suite of benefits with minimal scandium added will accelerate the deployment of AlSc alloys.

[1] Please see ASX announcement dated 30th August, 2016
[2] Please see ASX announcement dated 5th October, 2016

Scandium Market Development & Offtake Priorities

All sub-sectors of the global transport industry – automotive, aerospace, rail and marine – have compelling reasons to pursue cost-effective lightweighting solutions. The Clean TeQ marketing team engages with companies, seeking first-mover advantage on solutions that offer compelling economics and can be easily integrated into existing manufacturing processes. Collaborations are established with partners and applications that hold the best prospects for near-term offtake.

Scandium provides significant benefits to a broad range of aluminium alloys in a diverse set of metal offerings (see Figure 1). Selection of priority customers and applications requires investment to understand the complete cost-benefit of an AlSc solution. A range of physical and economic parameters need to be considered in optimising each application and the associated manufacturing process.

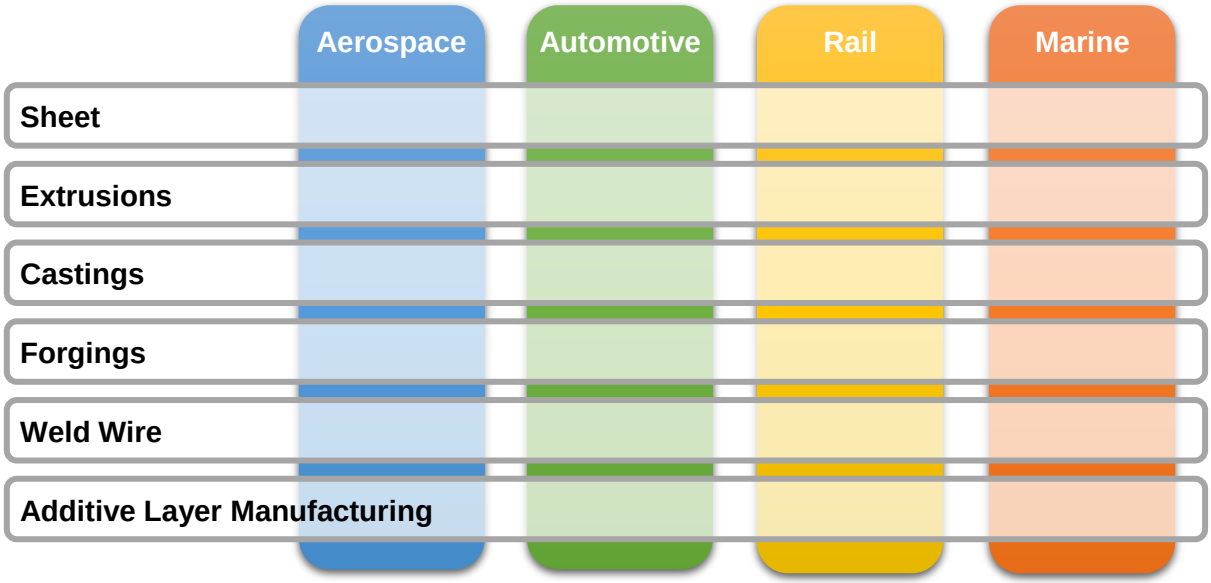

Figure 1: The scandium marketing matrix for global transportation

Clean TeQ focused initially on the aerospace industry, due to the substantial amount of work completed over many decades for the use of aluminium-scandium alloys in commercial airliners. This is still one of the key sectors for early adoption.

However, over the past six months, there has been significant and growing interest from the global automotive supply chain. Therefore, the Clean TeQ marketing team has broadened its focus on key companies within the aerospace and automotive sectors which will ensure the fastest route to commercial offtake of scandium oxide. In many cases, there are synergies between products and industries, with improvements in an alloy and/or component in one sector providing benefits to others.

Having identified a priority application, Clean TeQ's offtake strategy progresses through 3 logical steps:

1. Generating baseline data from addition of scandium to alloys of interest to estimate potential benefits and scope fast track alloy development programs. This work is carried out in the US facility of Clean TeQ's alloy expert, Dr. Tim Langan, and through our partnerships with key universities, such as Deakin University in Australia.

2. Establishing collaborations with key customers in each sector to test and define the complete value equation for a selected commercial component. This allows end users to properly assess the functional and commercial benefits and prepare for necessary changes to supply chains and production lines. An example of this is our collaboration with Universal Alloy Corporation[3], announced earlier this year.
3. Negotiating scandium oxide offtake agreements that satisfy the supply chain requirements for the targeted commercial components.

Engagement along the complete supply chain is critical for the growth of the scandium market and essential for the establishment of a robust and fully functional supply chain.

The following is a summary of the key applications and customers the Clean TeQ marketing team is focusing on to fast track adoption of AlSc materials in the global transport sector.

Aerospace

AIRBUS has pioneered the development of aluminium-scandium components for use in commercial aircraft. In the public domain, one can readily find information about AIRBUS' co-development with Aleris of aluminium-magnesium-scandium (AlMgSc) alloy sheet for fuselage applications[4]; and about AIRBUS' development of Scalmalloy® for 3D printed aircraft internal components[5].

High Strength Sheet for Fuselage Skins

Airbus and Aleris have co-developed a high strength AlMgSc alloy (AA5028) for use in fuselage skin on aircraft[6]. 5028 offers weight reduction opportunities relative to incumbent alloys both directly and through superior weldability. AlMgSc formability properties (see creep forming example in Figure 2 below) also enable drop-in solutions and streamlining of the aircraft production line. This allows for a reduction in the "buy-to-fly" ratio, as less material is required in the finished component and manufacturing processes can be used to minimise material waste.

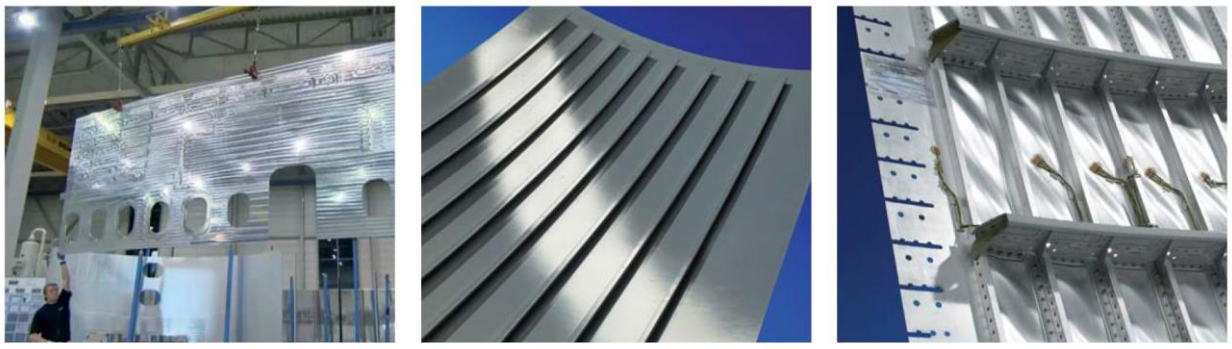

Figure 2: Aleris creep formed AlMgSc fuselage skin component

Clean TeQ's ongoing discussions with AIRBUS and Aleris are focused on the cost competitiveness of aluminium-scandium solutions over the life of an aircraft programme and de-risking the adoption of a new class of materials. Sustainably affordable pricing of scandium

[3] Please see ASX announcement dated 6th January, 2016
[4] Airbus and Aleris co-development of 5028 AlMgSc alloy: http://www.france-metallurgie.com/31923/
[5] For more information on AP Works, please see: http://www.apworks.de/en/
[6] Aleris: www.aleris.com; for more info on creep forming please see: https://youtu.be/SP2s2dXMYd4

raw materials is one key topic; reliability and diversity of supply are also important considerations.

Additive Manufacturing (3D Printing)

Airbus Group Innovations (AGI) is Airbus' global network of research and technology centres for future aerospace challenges. AGI is responsible for development, qualification and commercialisation of Scalmalloy®, a patented 3D printing AlSc powder and direct manufacturing concept used in the production of high strength components for Airbus' fleet of aircraft. Compared to all other aluminium alloys currently used in selective laser melting (a typical 3D printing process), Scalmalloy® offers outstanding mechanical strength values in combination with corrosion resistance, allowing the material's use without protective coatings. Compared to conventional 3D printing alloys (e.g. AlSiMg), Scalmalloy has demonstrated a 90% increase in yield strength while providing the same geometric freedom required for 3D printed components[7].

As published by Airbus Group[8] and Autodesk[9], Airbus is developing a 3D printed bionic designed structure for use in lightweight aircraft partitions. This represents one of many potential applications where Scalmalloy® may be used in aerospace and other industries.

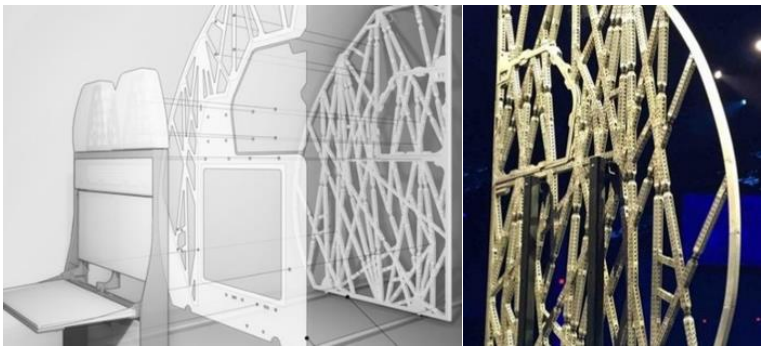

Figure 3: 3D Printed Scalmalloy®RP partition and Aleris creep formed AlMgSc part

Clean TeQ discussions with AGI have focused on integrating the scandium oxide supply chain with the Scalmalloy® manufacturing process. Syerston improves the competitiveness of Scalmalloy® through stable supply and pricing of scandium raw materials and recycling of existing waste streams.

High Strength Extrusions

In January, Clean TeQ entered a collaboration with Universal Alloy Corporation[10] (UAC) and Deakin University for the development of higher strength and improved surface finish extruded parts for aerospace. The work was supported by a government grant and was completed in September. The 9-month program investigated model alloys series to determine the effect of scandium addition on strength and impact on extrudability. Results have been very encouraging and have paved the way for additional work at Deakin University to optimise the scandium addition and processing parameters, as well as larger-scale trials at UAC.

[7] Farmer, et al, *Strategies to combined nanocomposite and additive layer manufacturing techniques to build materials and structures simultaneously*, 2012, Figure 1
[8] http://www.airbusgroup.com/int/en/story-overview/Pioneering-bionic-3D-printing.html
[9] http://www.autodesk.com/
[10] For more information on UAC's production facilities and extruded products, see: https://youtu.be/_xeBkx1gUgo

The collaboration was also recently successful in securing a 3-year Australian Research Council (ARC) Linkage Grant[11], providing matched funding for the development of aluminium-scandium alloys for extruded components in aerospace. The linkage grant is an excellent example of support from the Australian government to promote the growth of its manufacturing sector through development of applications using Australia's abundant natural resources.

Welding Wire

Aluminium alloys that are both very strong and very weldable offer the prospect of substantial weight savings in future aircraft, for example by reducing or eliminating the need for rivets. While small additions of scandium can dramatically improve the weldability of a range of aluminium alloys, an alternative approach is to introduce scandium units into weldments via a filler wire. High strength, high fatigue resistance welds can be achieved without modification to the base alloys, resulting in stronger finished components with no change to the current production process. Ease and reliability (quality) of the welding process are additional benefits.

Scandium-containing welding wire has application beyond aerospace, with potential in many aluminium components. Clean TeQ is currently working with a leading global welding wire manufacturer to undertake technical and commercial evaluation of AlSc welding wire, including production of welding wire samples for end user testing programs.

Automotive

The automotive industry is under considerable pressure to produce lighter vehicles with improved recyclability. For conventional cars, lighter materials of construction are often the only way to meet fuel efficiency and emission reduction targets. Additionally, electric vehicles need to find ways to offset the very substantial weight of the battery systems. Recyclability of material is also of key importance to the automotive industry as, unlike aerospace, this plays a much larger role in the total lifecycle cost of a vehicle. The combination of these factors has led to the automotive sector substantially increasing it use of aluminium, with 50% growth forecasted by 2020[12].

The need for stronger, more weldable and more formable aluminium is driving considerable automotive sector interest in scandium-containing alloys. Additionally, scandium is typically added as a trace material and can be used in normal alloy production processes, segregation of materials will be minimised. Clean TeQ is leveraging our experience of scandium in aerospace to fast track development of applications in automotive. Below are some examples of collaborations with key partners in the automotive industry to validate the benefits of aluminium-scandium alloys.

High Strength Extrusions for Body Frame & Crash Management Systems

Of upmost importance in the design of any vehicle is its ability to protect passengers against collisions on all sides. The internal skeleton of the car is made up of the main body frame with the crash management system (CMS) on the front and back of vehicle for crash protection.

The key feature of the CMS (e.g. bumpers, etc) is its ability to absorb energy without failure. The main body needs to have high strength to maintain structural integrity. Therefore, both strength and "ductility" (ability to absorb energy) are the key focus for materials used.

[11] ARC Linkage Grant: http://invenio.deakin.edu.au/linkage-programme-awards-for-deakin/
[12] Please see the Arconic website: http://www.arconic.com/global/en/what-we-do/automotive.asp

Traditionally, these sections have been made from heavier steel components. Substitution with high strength aluminium offers significant weight reduction without compromising safety.

Figure 4: Body structure[11] and crash management systems[13] produced from aluminium

The addition of scandium to aluminium in the extrusions for these components adds strength without affecting "ductility". Clean TeQ is currently in discussions with key alloy producers currently providing products to the automotive industry to establish programs utilising scandium for these applications.

<u>High Strength Sheet for Panels</u>

Aluminium has already been adopted in panels for some models by major car companies such as Ford, Jaguar Land Rover and Audi. Aluminium provides significant weight saving over traditional steel panels and much lower cost and higher recycle rates than carbon fibre alternatives, used in some high-end vehicles.

Figure 5: Aluminium panels for Ford's F-150 manufactured by Novelis[14]

Scandium can be used to promote wider adoption of aluminium in these applications. Scandium's potent strengthening effect allows thinner panels to be used, reducing weight. Where superior corrosion resistance is essential as well as increased strength, an adapted AlMgSc alloy may prove to be the optimal solution. Scandium also improves formability, which means panels can incorporate more complex features – a highly desirable benefit for car companies looking for differentiated aesthetics. Clean TeQ is in discussions with key suppliers to promote the adoption of high strength, high formability panels in the automotive sector. One such company is Bmax[15], which has developed a unique electro-hydraulic forming (EHF) and magnetic pulse forming (MPF) process to produce much more complex shapes with significantly less processing steps. Clean TeQ and Bmax are exploring the potential to

[13] Please see the Constellium website: http://www.constellium.com/aluminium-products/automotive-structures
[14] http://novelis.com/markets-we-serve/automotive/
[15] For more information on Bmax, please see http://www.bmax.com.

combine highly formable scandium-containing alloys with Bmax's processes to provide lighter, lower cost parts for the automotive industry.

Castings

Casting is an important way to produce components with complex geometries, ranging from body nodes to wheels. One of the benefits of casting is the ability to reduce the number of parts required to assemble a complete vehicle, to achieve critical technical and commercial objectives.

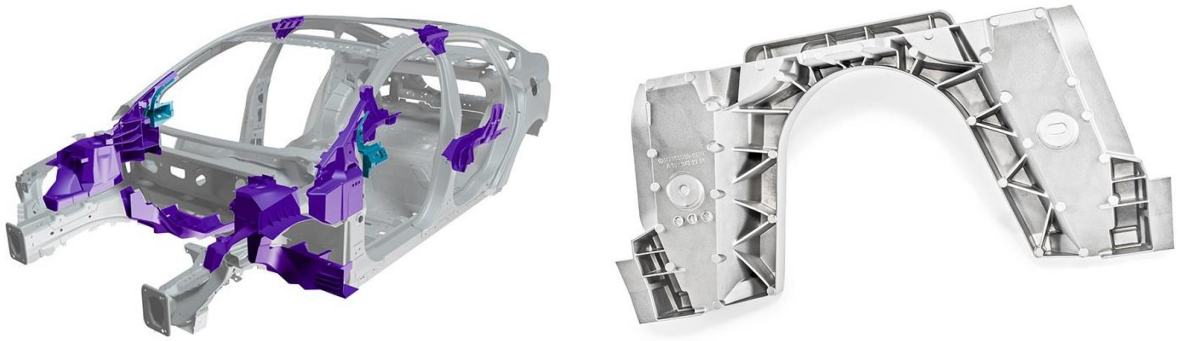

Figure 6: Aluminium cast parts for automotive [16]

Castable silicon-containing alloys are typically used to produce these components to the required specification. The automotive sector has great interest in designing new casting alloys that preserve or improve formability while increasing strength.

Clean TeQ has initiated pre-competitive development work with a North American consortium which will challenge conventional wisdom about the role of scandium in silicon-containing alloys. Successful outcomes will open a whole new set of attractive component markets for aluminium-scandium.

Global Scandium Marketing Team

The market for scandium alloys will take time and resources to develop, but Clean TeQ is confident that, based on the level of interest it sees in the market and the imperatives facing the global transport industry to deliver lightweighting solutions, scandium will become an increasingly strategic metal given its wide application across a range of commonly used, high volume industrial alloys. If priced correctly to deliver value to customers and produced from a large, long-life supply source in a stable part of the world, scandium can be a catalyst for driving significant value into the global aluminium supply chain and the next generation of transport technologies.

Clean TeQ has been quick to recognise the importance of working with both the end users and the major aluminium producers to build demand for aluminium-scandium alloys in an orderly fashion. Our marketing team consists of highly qualified individuals in key geographic regions to:

- build awareness that reliable, low-cost scandium supply can be made available;
- support application-focused alloy development work; and

[16] http://www.magna.com/capabilities/body-chassis-systems/innovation-technology/aluminum-casting

- identify opportunities for first-mover advantage across all sectors of the global transport industry.

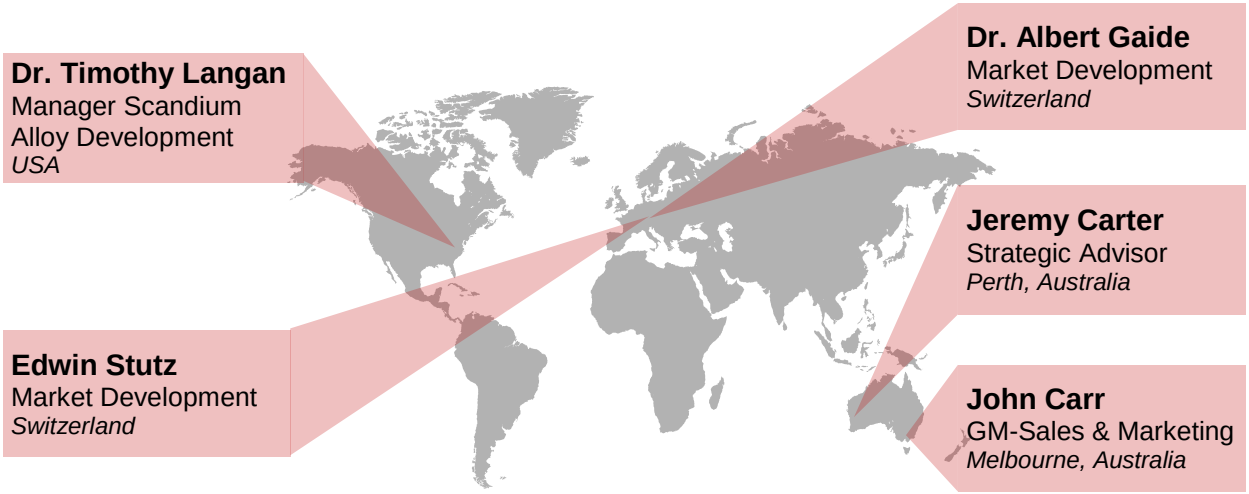

Figure 7: Clean TeQ Global Scandium Marketing Team

Dr Timothy Langan has been with Clean TeQ since November 2015, leveraging his extensive network in the alloy, aerospace and military industries to establish applications and customers for scandium-containing alloys. Tim has extensive experience in all aspects of development and commercialisation of advanced material technologies. As President of Surface Treatment Technologies, Tim worked with the US Navy to develop and commercialize a scandium containing aluminium alloy for ship structures. Tim was the Technical Director of Ashurst Technologies, a company which refined and commercialised technologies and alloys developed in the former Soviet Union. Prior to Ashurst, Tim was the Group Leader for the Advanced Alloys Department at Martin Marietta Laboratories (now Lockheed Martin) where he was responsible for development and commercialisation of a range of aluminium alloys for aerospace and space.

Dr Albert Gaide has over 40 years' experience in business development, management consulting and material/process R&D for several industries, including aerospace, space and military. With previous engagements with OEMs, institutions and manufacturing companies across Europe and USA, Dr Gaide has an extensive network throughout the complete supply chain of these industries, with a deep understanding of the commercialisation processes required for new materials.

Edwin Stutz has over 30 years in the development and management of tool making equipment for the automotive, aerospace and electronics industries. Edwin previously worked for Agie S.A (now a subsidiary of Georg Fischer), one of the world's preeminent precision tool making equipment. Edwin was responsible for the global development for the company, managing teams across Switzerland, USA and China. Through his time at Agie, Edwin has worked with many of the Tier 1 component suppliers to the automotive industry.

Both Albert and Edwin are based in Switzerland and joined the marketing team in August.

Jeremy Carter has been a management consultant for 30 years, specialising in performance improvement and innovation. His experience allows Clean TeQ to support customers in identifying the highest value-adding applications for aluminium-scandium alloys.

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About Clean TeQ Holdings Limited (ASX: CLQ) – Based in Melbourne, Clean TeQ, using its proprietary Clean-iX® continuous ion exchange technology, is a leader in metals recovery and industrial water treatment. For more information about Clean TeQ please visit the Company's website at www.cleanteq.com.

About the Syerston Scandium Project – Clean TeQ is the 100% owner of the Syerston Project, located in New South Wales. The Syerston Project is one of the largest and highest grade scandium deposits in the world and one of the highest grade and largest cobalt deposit outside of Africa.

This release may contain forward-looking statements. The actual results could differ materially from a conclusion, forecast or projection in the forward-looking information. Certain material factors or assumptions were applied in drawing a conclusion or making a forecast or projection as reflected in the forward-looking information.