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## THUNDERBIRD ILMENITE EXCEEDS PREMIUM SPECIFICATION

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### HIGHLIGHTS

- Test work delivers ilmenite product with premium specifications for Chinese market
- Outstanding reduction in Fe<sub>2</sub>O<sub>3</sub> content and increase in reactivity
- One of the highest grade sulfate ilmenites available globally (56 - 58% TiO<sub>2</sub>)
- Offtake discussions progressing in parallel with product optimisation and funding evaluation
- BFS remains on schedule for release in Q1 2017

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Sheffield Resources Limited (“Sheffield”, “the Company”) (ASX:SFX) is pleased to report further positive results following the completion of Low Temperature Roast (LTR) optimisation test work conducted for the Bankable Feasibility Study (BFS) on its 100% owned world class Thunderbird Mineral Sands Project (Thunderbird), near Derby in northern Western Australia.

The BFS, which is being managed by leading engineering firm Hatch on behalf of Sheffield, remains on schedule for release in Q1 2017.

Test work recently completed by Roundhill Engineering Pty Ltd and IHC Robbins has successfully optimised LTR settings to deliver a product which is likely to exceed premium specifications for the large Chinese market and increase marketability in the broader global market.

This follows recent marketing and offtake discussions in Asia which confirmed Thunderbird LTR ilmenite as significantly higher grade (56 - 58% TiO<sub>2</sub>) and lower in key impurities than existing African and Australian ilmenites imported to China (Table 1). This most recent test work has achieved premium specifications for the Chinese sulfate pigment market by generating an ilmenite product with Fe<sub>2</sub>O<sub>3</sub> levels below 13%, whilst maintaining high acid solubility and reactivity.

Sheffield’s Managing Director Bruce McFadzean described the results as outstanding and a significant breakthrough for the Company as it progresses towards development of Thunderbird.

“The Thunderbird ilmenite product is now at the top end of the quality spectrum and will compete with all global ilmenites due to its high grade, low impurities and high reactivity. Results demonstrate the flexibility of Sheffield’s ilmenite upgrading process allowing premium products to be tailored to a broader range of customers.

“Thunderbird ilmenite will be one of the highest grade sulfate feedstocks available globally and will likely displace other lower quality ilmenites in the market.

“Offtake discussions have progressed with leading global ilmenite and zircon consumers. Further ilmenite samples will be dispatched over the coming weeks to advance those discussions. We continue to progress discussions in parallel with completion of the BFS and the evaluation of funding options and potential partnering opportunities.

“We are pleased that improved market conditions for mineral sands are emerging, particularly for sulfate ilmenite, with prices rising by 50% over the past 12 months. Zircon prices have also improved over this period as mines have closed and global inventories have begun to unwind,” Mr McFadzean concluded.

## Background

Low Temperature Roast (LTR) continuous pilot-scale test work was completed during 2016 on 1.5 tonnes of ilmenite at Hazen Laboratories in Colorado, USA and was managed and supervised by Hatch and Roundhill Engineering Pty Ltd on behalf of Sheffield. The LTR stage facilitates the removal of ferric iron dominant minerals from the primary ilmenite. Results from batch and continuous pilot plant test work were successful in reducing the excess ferric iron in the primary ilmenite, and produced a high grade 56.1% TiO<sub>2</sub> LTR ilmenite, with significant improvements in the FeO:Fe<sub>2</sub>O<sub>3</sub> ratio to 1.2 (refer ASX announcement 12 October 2016).

Subsequent marketing and offtake discussions in Asia, including sample testing and appraisal confirmed Sheffield's Thunderbird BFS ilmenite product as a suitable blended feedstock with domestic Chinese ilmenite. Product appraisal by potential consumers indicated that if Fe<sub>2</sub>O<sub>3</sub> levels could be reduced to levels comparable to premium Indian ilmenite (i.e. <13%) then premium pricing could be achieved. A high grade feedstock with these specifications would be ideal for blending with lower grade and less reactive ilmenites.

The recent test work completed by Roundhill Engineering Pty Ltd and IHC Robbins has refined the low temperature roast conditions to achieve premium specifications for the Chinese sulfate pigment market (Table 1). These subtle changes to the roast upgrade process have minimal impacts on operating and capital costs. A key outcome from this test work is that the percentage of Fe<sub>2</sub>O<sub>3</sub> is controllable, therefore the ilmenite product can be tailored to customer requirements within a range from 18% to 10%.

Composition (%)	Thunderbird Optimise 3 ilmenite	Premium Indian ilmenite	East African ilmenite	Southeast African ilmenite	West African ilmenite	East Australian ilmenite
TiO <sub>2</sub>	57.9	51.5	48.2	52.4	53.2	50.7
FeO	28.1	33.5	25.5	21.4	18.9	25-29
Fe <sub>2</sub> O <sub>3</sub>	10.3	13.0	20.0	27.9	23.3	16-19
FeO:Fe <sub>2</sub> O <sub>3</sub>	2.7	2.6	1.3	0.8	0.8	1.5
Cr <sub>2</sub> O <sub>3</sub>	0.05	0.04	0.09	0.09	0.16	0.30
CaO	0.02	0.08	<0.01	0.02	0.01	0.02
MgO	0.21	0.64	0.80	0.30	0.61	0.85

**Table 1.** Table of key specifications for Thunderbird optimised ilmenite and other competing sulfate ilmenites - source Sheffield, TZMI.

Subsequent acid solubility test work completed by Roundhill Engineering Pty Ltd confirmed that very high reactivity and TiO<sub>2</sub> solubility has been maintained. (Table 2).

Sample	% TiO <sub>2</sub>	% FeO	% Fe <sub>2</sub> O <sub>3</sub>	FeO:Fe <sub>2</sub> O <sub>3</sub> Ratio	% TiO <sub>2</sub> Solubility
Optimise 1	57.5	20.8	18.0	1.2	98.4
Optimise 2	57.5	23.9	14.9	1.6	98.9
Optimise 3	57.9	28.1	10.3	2.7	95.4

**Table 2.** Assay results and TiO<sub>2</sub> solubility results

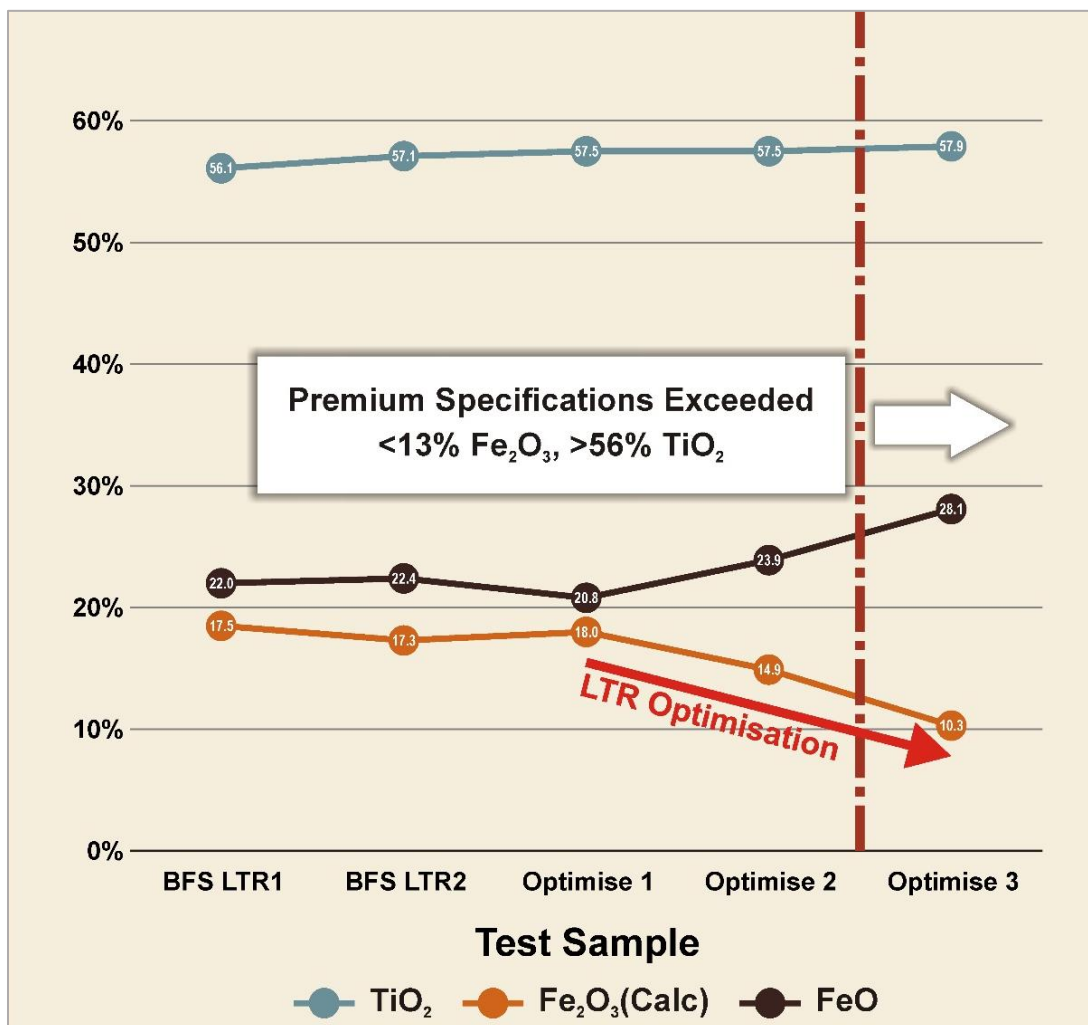


Figure 1: Line graph showing progression of Thunderbird ilmenite test work results and TiO<sub>2</sub>, Fe<sub>2</sub>O<sub>3</sub> and FeO product specification

For Chinese sulfate plants, ilmenite products with low Fe<sub>2</sub>O<sub>3</sub> and high reactivity offer the option of being direct feed, or can be blended with lower grade, domestic hard rock ilmenite. A significant benefit of the high TiO<sub>2</sub> grade and low Fe<sub>2</sub>O<sub>3</sub> content is the lower levels of waste produced. In addition, highly reactive ilmenites require lower acid and metallic iron consumption resulting in lower operating costs at the sulfate pigment plants. In China there is a growing requirement for increased environmental regulation of the industry which supports the use of higher grade feedstocks that generate lower proportions of waste material.

Additional marketing samples will be processed under the optimised LTR conditions tailored for the Chinese and European markets with samples to be dispatched for customer testing in the coming months. Sheffield will continue to work with potential customers to deliver premium products specific to individual customer requirements.

The company will also continue to investigate the potential supply of high grade TiO<sub>2</sub> ilmenite (56%-58% TiO<sub>2</sub>) containing low alkalis as a potential blended feedstock for the chloride market.

**Market Conditions**

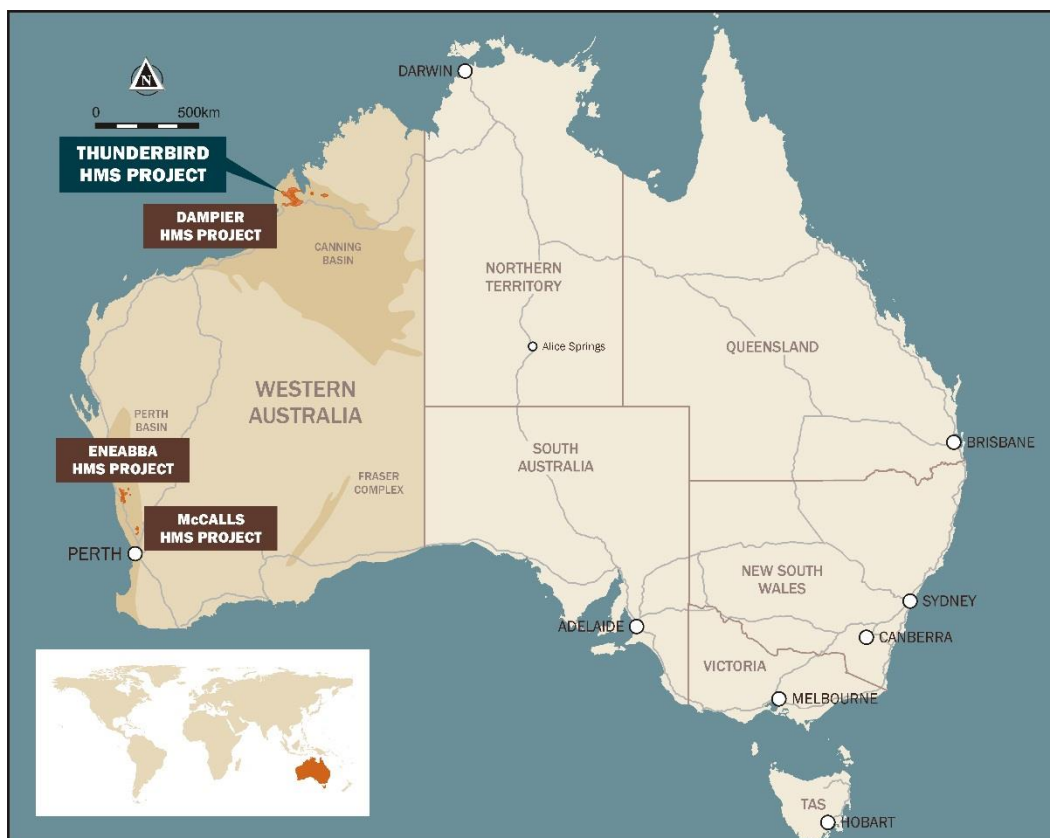
Market conditions, particularly for sulfate ilmenite, indicate prices are rising after four years of decline. Markets are indicating strong initial rises in high grade TiO<sub>2</sub> sulfate feedstock prices with tight supply conditions to remain throughout 2017 and beyond. As global inventories of zircon sand have declined,



prices have started to show signs of recovery with price increases implemented and accepted by the market. Further price increases have been implemented during Q1 of the 2017 calendar year and additional incremental price increases are expected during 2017.

**BFS Update**

The BFS, which is being managed by leading engineering firm Hatch on behalf of Sheffield, remains on schedule for release in Q1 2017. All metallurgical and engineering design work is complete with finalisation of the BFS Ore Reserve and financial modelling imminent. The construction tender process is well advanced and offtake discussions remain a high priority.



**Figure 2:** Location of Thunderbird Project

**ENDS**

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## COMPLIANCE STATEMENTS

The information in this report that relates to Technical Results (metallurgical test work) is based on information compiled by Mr Mark Teakle, a Competent Person who is a Member of the Australian Institute of Geoscientists (AIG). Mr Teakle is a full-time employee of Sheffield Resources Ltd and has sufficient experience that is relevant to the style of mineralisation and type of deposit under consideration and to the activity being undertaken to qualify as a Competent Person as defined in the 2012 Edition of the 'Australasian Code for Reporting of Exploration Results, Mineral Resources and Ore Reserves'. Mr Teakle consents to the inclusion in the report of the matters based on his information in the form and context in which it appears.

## PREVIOUSLY REPORTED INFORMATION

This report includes information that relates to Technical Studies which were prepared and first disclosed under the JORC Code 2012. The information was extracted from the Company's previous ASX announcements as follows:

- Thunderbird BFS Update: "OUTSTANDING IMPROVEMENTS IN RECOVERIES AND PRODUCT SPECIFICATIONS FROM THUNDERBIRD BFS" 12 October, 2016
- Thunderbird BFS Update: "THUNDERBIRD MINERAL SANDS PROJECT - BFS UPDATE" 29 June, 2016.

The Company confirms that it is not aware of any new information or data that materially affects the information included in the original market announcements and, in the case of estimates of Mineral Resources, Ore Reserves, Pre-feasibility Study and Technical Study results, that all material assumptions and technical parameters underpinning the estimates in the relevant market announcement continue to apply and have not materially changed. The Company confirms that the form and context in which the Competent Person's findings are presented have not been materially modified from the original market announcement.

## FORWARD LOOKING AND CAUTIONARY STATEMENTS

Some statements in this report regarding estimates or future events are forward-looking statements. They involve risk and uncertainties that could cause actual results to differ from estimated results. Forward-looking statements include, but are not limited to, statements concerning the Company's exploration programme, outlook, target sizes and mineralised material estimates. They include statements preceded by words such as "anticipated", "expected", "targeting", "likely", "scheduled", "intends", "potential", "prospective" and similar expressions.

## ABOUT SHEFFIELD RESOURCES

Sheffield Resources Limited is focused on developing its 100% owned, world class Thunderbird Mineral Sands Project, located in north-west Western Australia. Sheffield continues to explore the Dampier Project for other mineral sands targets identified within the region.

Sheffield is also exploring the Eneabba and McCalls regions north of Perth, Western Australia for mineral sands deposits. As an exploration company, Sheffield continues to assess other regional exploration opportunities.

## THUNDERBIRD MINERAL SANDS

Thunderbird is one of the largest and highest grade mineral sands discoveries in the last 30 years.

The deposit is rich in zircon, which sets it apart from many of the world's operating and undeveloped mineral sands projects which are dominated by lower value ilmenite.

Sheffield's Pre-Feasibility study shows Thunderbird is a modest capex project that generates strong cash margins from globally significant levels of production over a 40 year mine life.

The Company is targeting project construction commencing in 2017 with initial production in 2019. The initial planned production profile is aligned with expected emerging supply gaps in global mineral sands markets

ASX Code:	SFX	Market Capitalisation:	A\$100m
Issued shares:	181.0m	Cash (unaudited, 28 Feb 2017):	A\$11.7m