

# ASTRON CORPORATION LIMITED (ATR) INITIATION REPORT: A RARE (EARTHS) OPPORTUNITY

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## KEY POINTS

Initiate with BUY rating and target price \$1.54 for 117% upside.

The industry's ability to now successfully process finer grained mineral sands deposits, the addition of a valuable rare earth product stream and a pending gap in the global zircon market as existing mines deplete means Astron's long awaited Donald Project is now development ready.

## INVESTMENT VIEW AND VALUATION

Astron Corporation Ltd (ATR) is a mineral sands company who's major asset is the large long-life Donald Rare Earth and Mineral Sands Project in Western Victoria. Astron also owns other assets in the Niafarang Mineral Sands Project in Senegal, and mineral sands processing and trading assets in China.

We value Astron at \$3.08/share assuming Donald Stage 1 is developed in the coming 3 years. Our inputs include Stage 1 capex of A\$400m and conservative zircon and rare earth commodity prices.

## KEY DRIVERS

**Feasibility, customer offtake, and finance:** The Donald Project is approaching a Final Investment Decision planned for end of 2023 and key imminent steps include release of updated feasibility study in Q1 and by end of Q3 customer offtake agreements that should support the raising of debt and equity capital to underpin project development.

**Zircon supply gap:** The global market is set to see a decline in zircon supply within 2 years due to mine depletion providing a market window of opportunity for Astron to now sign offtake agreements.

**A critical minerals rare earth solution:** The addition of the rare earth product stream that includes monazite (neodymium and praseodymium, used in wind turbines and hard drives) and xenotime (dysprosium and terbium, used in EVs and submarines) adds to the projects economic returns and puts the Donald Project into a class of projects that can help meet the critical minerals supply chain development targets for Australia.

## CATALYSTS

- Q1 2023 Ore Reserve Update
- Q1 2023 Revised Feasibility Study
- Q3 2023 **Execute Offtake agreements with customers**
- 2H 2023 **Debt & equity capital to underpin development including reasonable but not full participation from major shareholder to aid in further increases in liquidity of shares as recently demonstrated in December when dropped from 77% to 72%.**
- Q3 2023 Workplan for Victorian State Regulator Submission
- Q1 2024 Final Investment Decision
- Q1 2024 **Construction Commencement**
- Q3 2025 Commissioning
- Q4 2025 First Production

## RISKS

Risks for Astron and in particular the Donald Project upon which our company valuation is based upon **include but are not limited** to zircon and rare earth commodity pricing, the ability to raise sufficient debt and equity capital to develop the project, regulatory risk including obtaining the required Work Plan from the Victorian State Government (most regulatory approvals are in place), and the risks for shareholders that come with a concentrated share register with a 77% major shareholder (although we fully see interest as aligned

Recommendation	Buy
Previous Recommendation	Initiating Report
Risk Rating	High
Current Share Price	\$0.62
12 Month Price Target	\$1.54/share
Price target Methodology	50% of DCF
Total Return (Capital + Yield)	117%
DCF Valuation	\$3.08/share
Market Capitalisation	\$95m
Liquidity	~\$10k/day

Financial Forecasts				
Y/e Jun (\$m)	202F	2024F	2025F	2026F
HMC Production	0	0	275.7	275.7
REEC Production	0	0	8.9	8.9
EBITDA	(2.3)	(2.3)	116.1	116.1
EPS (cps)	(3.6)	(2.4)	30.7	23.9
DPS (c)	0	0	15.3	11.9
EV / EBITDA (x)	N/A	N/A	1.0	1.0
PER (x)	N/A	N/A	2.3	3.0
Dividend Yield	0%	0%	22%	17%

Source: PAC Partners Analysis

## Astron 12 month share price chart



Source: CapIQ

Market Data	ATR		Astron - Valuation	IRR	A\$m	A\$/share
Price \$	0.71		Donald RE & MS (St 1)	28%	412	3.09 96%
12 month target price (50% of NPV)	1.54	117%	China processing plant		13	0.10 3%
Shares out (mill)	133.2		Senegal Niarang MS Project		2.5	0.02 1%
<b>Mcap A\$m</b>	<b>94.6</b>		Contingent (Gambia A\$33m)		1.0	0.01 0%
Cash on hand last qtr \$m	5.4	Dec-22	Corporate and other		-	-
Debt - China operations \$m	-6.0		<b>Sub Total</b>		<b>428</b>	<b>3.21 100%</b>
Debt - DIRs (\$5.9m), China ST (\$5.9m), Converts (\$4.9m)	-16.7		Net debt		17	0.13
<b>Net cash (debt)</b>	<b>-17.3</b>		<b>Potential Equity Value</b>		<b>411</b>	<b>3.08 334%</b>
<b>Enterprise value</b>	<b>112</b>		WACC used			10%
			Shares used (million)			133.2

Other securities on issue	Number	Expiry	Strike	Share Register	#	%
Convertible notes principal (Collins St Capital)	50,000	Mar-24	0.54	Kobe / Bealey (T. Brown)	96,018,824	72%
Convertible notes supplementary (Collins St Capital)	10,000	Mar-24	0.54	Juhua International	4,000,000	3%
Other options	5,100,000	Various	Various	Other: Citicorp Nom	7,445,214	6.1

NB: T. Brown held 77% until Dec-22 cap raise.

Management	Directors
Mr Tiger Brown Managing Director / CEO	Mr George Lloyd Chairman, NED
Mr Greg Bell Chief Financial Officer	Mdm Kang Rong Executive Director
Mr Sean Chelius Donald Project Director	Mr Tiger Brown Managing Director / CEO
Mr Tim Chase Head of Global Operations	Dr Mark Elliot NED
Mr Joshua Theunissen General Counsel & Company Secretary (Aust)	Mr Gerard King NED
Mr John Yeates Senior Approvals & Environment Manager	

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Key Drivers	Guidance	FY22	FY23	FY24	FY25	FY26	FY27	FY28	FY29	FY30
HMC Product US\$/t						403	403	403	403	403
REEC Product US\$/t					11,000	11,000	11,000	11,000	11,000	11,000
Rare earth concentrate % of Donald revenue	50%	0%	0%	0%	47%	47%	47%	47%	47%	47%
Zircon Premium (ZrO2 conc. 66%+) US\$/t					2,100	2,100	2,100	2,100	2,100	2,100
...% Zr in HMC Price	80%				81%	81%	81%	81%	81%	81%
Total Ore Mined (Mt)	7.5				7.50	7.50	7.50	7.50	7.50	7.50
Production: HM Concentrate (ktpa)	250-300				276	276	276	276	276	276
Production: Rare Earth Concentrate (ktpa)	7-10				8.9	8.9	8.9	8.9	8.9	8.9
TiO2 recovery					75%	75%	75%	75%	75%	75%
ZrO2 recovery					89%	89%	89%	89%	89%	89%
CeO2 recovery					86%	86%	86%	86%	90%	90%

For Donald, contained Nd/Pr assumes monazite contains 67% TREO, and Nd/Pr oxides account for 21% of the TREO.

FX:AUD:USD 0.70 0.70 0.70 0.70 0.70 0.70 0.70 0.70 0.70 0.70

Reserves	FY22	FY23	FY24	FY25	FY26	FY27	FY28	FY29	FY30
<b>Total Reserves</b>			<b>602</b>	<b>595</b>	<b>587</b>	<b>580</b>	<b>572</b>	<b>565</b>	<b>557</b>
HM Grade %			4.80%	4.86%	4.81%	4.75%	4.70%	4.64%	4.58%
HM Contained in Reserves			28.9	28.9	28.2	27.5	26.9	26.2	25.5
Assemblage of HM (%HM)									
Ilmenite			32%	32%	32%	32%	32%	32%	32%
Leucoxene			20%	20%	20%	20%	20%	20%	20%
Rutile			7.4%	7.4%	7.4%	7.4%	7.4%	7.4%	7.4%
Zircon			17%	17%	17%	17%	17%	17%	17%
Monazite			1.6%	1.6%	1.6%	1.6%	1.6%	1.6%	1.6%

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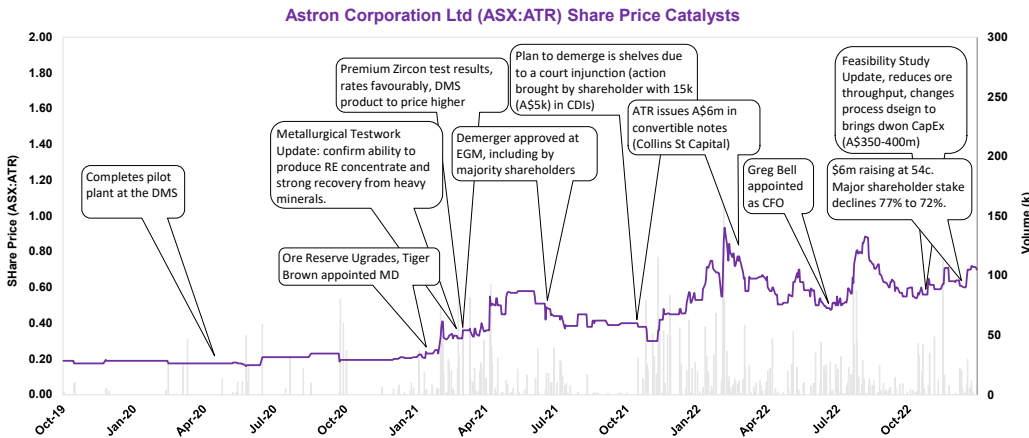
Cashflow (A\$m) (June YE)	FY22	FY23	FY24	FY25	FY26	FY27	FY28	FY29	FY30
Sales	18.5	20.0	20.0	318	318	318	318	318	318
Expenses	(18.1)	(21.8)	(21.8)	(202)	(202)	(202)	(202)	(202)	(202)
Tax	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<b>Operating CF</b>	<b>0.4</b>	<b>(1.8)</b>	<b>(1.8)</b>	<b>116.6</b>	<b>116.6</b>	<b>116.6</b>	<b>116.6</b>	<b>116.6</b>	<b>116.6</b>
Capex- exploration & development	(6.2)	(0.2)	(175)	(175.2)	(0.2)	(0.2)	(0.2)	(0.2)	(0.2)
Capex - maintenance	(0.5)	(1.5)	(6.5)	(6.5)	(6.5)	(6.5)	(6.5)	(6.5)	(6.5)
Total Capex	(6.7)	(1.7)	(182)	(182)	(6.7)	(6.7)	(6.7)	(6.7)	(6.7)
<b>FCF</b>	<b>(6.3)</b>	<b>(3.5)</b>	<b>(184)</b>	<b>(65.1)</b>	<b>109.9</b>	<b>109.9</b>	<b>109.9</b>	<b>109.9</b>	<b>109.9</b>
Debt net movement	4.5	(1.7)	232.3	(25.6)	(19.1)	(25.1)	(68.8)	(64.8)	(60.8)
Equity raised	0.0	5.9	77.0	63.0	0.0	0.0	0.0	0.0	0.0
Other	(0.6)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<b>Net cashflow</b>	<b>(2.4)</b>	<b>0.7</b>	<b>125.8</b>	<b>(27.7)</b>	<b>90.8</b>	<b>84.7</b>	<b>41.1</b>	<b>45.1</b>	<b>49.1</b>
Ending cash	2	3	129	101	192	277	318	363	412

Figure 1: Mineral Sands Peer-group Analysis

	Ticker	Price (local)	Mkt Cap (local \$M)	Net Debt (\$m)	EV (local)	EV (US\$)	Mineral Resource (MT)	HM Grade (%)	EV/Resource
<b>ASX Listed A\$</b>									
Iluka	ILU	10.5	4,534	-283	4250.7	2,975.5	3,105	5.9%	16.24
Strandline	STA	0.40	489	59.3	547.9	383.5	1,606	1.8%	13.22
Base Resources	BSE	0.23	259	-26.4	232.7	162.9	2,785	4.1%	1.42
VHM Limited	VHM	0.97	191	-43.0	148.2	103.7	629	2.9%	5.65
Sovereign Metals	SVM	0.405	188	-3.7	184.6	129.2	1,775	1.0%	7.21
Image Resources	IMA	0.14	144	-79.5	64.1	44.9	209	2.9%	7.31
Sheffield Resources	SFX	0.56	194	-5.1	189.3	132.5	7,940	4.1%	0.40
<b>Astron</b>	<b>ATR</b>	<b>0.715</b>	<b>95.2</b>	<b>15.3</b>	<b>110.5</b>	<b>77.4</b>	<b>2,634</b>	<b>4.6%</b>	<b>0.64</b>
Diatreme Resources	DRX	0.025	90	-5.0	84.5	59.2	203	4.7%	6.20
Mineral Commodities Ltd	MRC	0.07	48	5.4	53.8	37.6	585	7.1%	0.91
Dome Gold Mines Ltd	DME	0.20	71	-3.7	66.8	46.8	190	12.7%	1.94
IperionX	IPX	0.83	145	-14.3	130.4	91.3	431	2.2%	9.63
Sierra Rutile	SRX	0.22	93	-9.4	83.9	58.8	752	1.8%	4.35
<b>Micro Listed A\$</b>									
Astro	ARO	0.071	19	-0.9	18.3	12.8	118	4.4%	2.46
ACDC	ACD	0.19	14	0.0	13.7	9.6			
Heavymetals	HVY	0.115	4	-3.6	0.6	0.4	225	3.4%	0.06
MRG Metals	MRQ	0.004	9	-0.5	8.4	5.9	860	4.9%	0.14
Titanium Sands	TSL	0.013	18	-0.8	17.5	12.2	265	4.4%	1.05

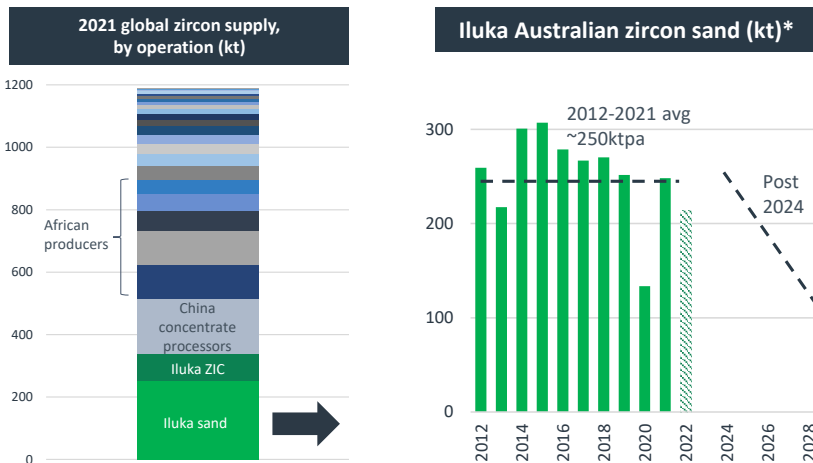
Source: Company Announcements, CapIQ, PAC Partners Analysis, priced 24 January 2023

Figure 2: Astron share price and key recent events



Source: CapIQ, Company Announcements, PAC Partners Analysis

Figure 3: Iluka's Jacinth Ambrosia Mine supplied over 20% of global zircon but closure approaches after 2023.



Source: Iluka 2H 2022 results presentation

## KEY POINTS

The Donald Mineral Sands project represents a Tier 1 mineral sands resource.

The Donald Project was last slated for development in 2014-17.

Contrasting with many ASX critical minerals peers, resource life is not an issue for the Donald Project.

The project is near shovel ready with a Phased approach designed to make it more executable than previous versions.

Third party processing is proposed for Phase 1, but production from Donald will also provide potential critical minerals processing development opportunities in Australia.

**Wimmera region of Victoria is a potential multi-decade source of critical minerals zircon and rare earths.** This aspect has been one of the features of recent ASX listings VHM Ltd (VHM) and ACDC Metals (ACD). (NB: PAC Partners lead the IPO process of ACD) However, one of the earliest discoveries in the area and one of the largest projects of its type in the world, is Astron's Donald Rare Earths and Mineral Sands project. It represents a near fully permitted Tier 1 mineral sands and rare earth resource that at full production (Phase 2) has the potential to supply ~8% of the global zircon market and 4% of the global titanium feedstock market.

**A revised feasibility study is due Q1 2023.** Ahead of this the company has outlined a new revised framework of a smaller and less capital intensive project. This is designed to be a far more executable project compared to the previous time it was put forward in the challenging mining and commodity price environment of 2014-2017.

**An abundant long life resource of critical minerals.** The sheer size of the Donald Project means it is a multi-decade project opportunity and contrasts with the smaller mining companies mentioned above and other critical minerals companies who tend to need to focus on resource and mine life extensions via exploration.

**Near shovel ready.** The Donald Project generally receives strong community support, has no outstanding native title issues, and has advanced environmental approvals in place (first approved Environmental Effect Statement in 2009 and mining licence in 2010).

**Industry has progressed to become more comfortable with fine grained mineral sands deposits.** Wimmera (WIM) Style deposits such as Donald Project remain, on the whole, "un" and "under" developed due to their lower relative grade, high tonnage and challenges associated with processing of the finer grain sands. However higher grade projects have been exhausted and after extensive process testing Astron is to overcome challenges with industry technology (MG-12 Spirals) that is being increasingly used elsewhere (e.g. Strandline's Thunderbird Project WA).

The scale of the Donald Project means that a staged development approach has been chosen compared to previous designs. While this reduces the capital cost it will also give Astron flexibility to fine-tune processing, mining and downstream offtakes early in the project's life.

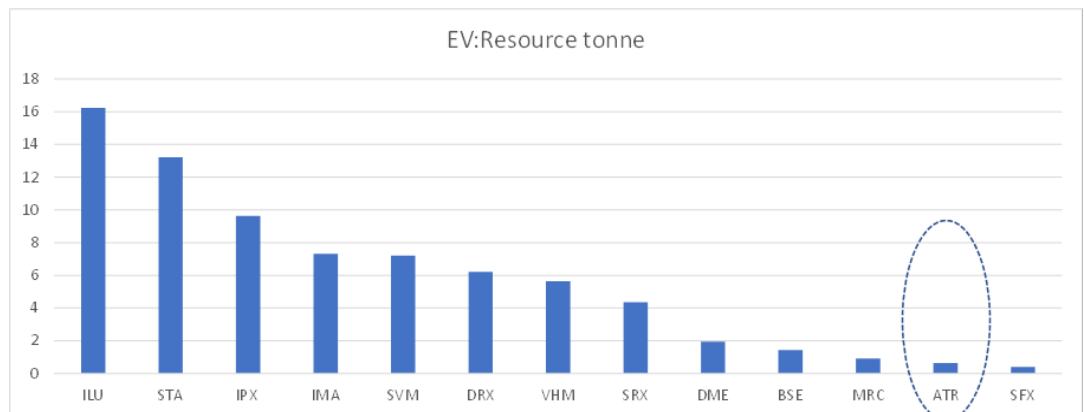
In our valuation and report we primarily focus on the first phase of development:

### Phase 1: FY25... 7.5Mtpa

- 7.5Mtpa of mining and ore throughput for average production of two concentrate product streams:
  - 250ktpa** of Heavy Mineral Concentrate
  - ~8ktpa** of Rare Earth Element Concentrates.
- These rates of production could be sustained for ~35 years.
- Development capex range of ~A\$350 to A\$400m.
- Mining strip ratio of 1.9:1 in the first 4 years of production, and 2.2:1 for the subsequent 31-years of production.

**Third party processing for at least Phase 1.** Production of the final products (zircon and titania HM products, and the constituent rare earths) is to be done off-site by third-party separation facility or for HMC could be conducted at Astron's own separation plant in Yingkou in China (or a combination of these two).

Figure 4: Peer Companies... On an EV:Resource basis, ATR is one of the least expensive companies.



Source: Company Announcements, PAC Partners analysis, peer companies referenced in Fig 1.

# PROJECT MODEL – KEY ASSUMPTIONS AND SUMMARY OUTPUT

## KEY POINTS

The Donald Mineral Sands Project Stage 1 has a robust NPV of over \$400m and an IRR of over 25% under our assumptions.

While we are yet to model additional phases, the conceptual plan after Stage 1 is to at least double production capacity and establish an on-site mineral separation plant to capture more value locally.

Key sensitivities for project valuation are zircon prices and price received for the basket of rare earths produced. A 10% change in either of these prices would lead to a near 20% change in valuation.

We assume 65% debt funded capital for project development.

Offtake agreement and potential prepayments from customers could be a key source of initial financing.

We assume \$140m shall need to be raised in equity finance, and model this over a 2 tranches over coming 2 years.

Donald Project - Valuation Model			Comments
Life of Mine	Yrs	35	Significant upside
Ore Mined Per Year	Mt	7.5	Stage 2 doubles production
Strip Ratio	Avg LoM	x	2.2
<b>HMC Production</b>	<b>kt</b>	<b>276</b>	<b>Guide 250-300</b>
<b>REEC Production</b>	<b>kt</b>	<b>8.9</b>	<b>Guide 7-10</b>
Zircon Price (ZrO2 conc. 66%+)	US\$/t	2,100	Dominant HM
Rutile Price	US\$/t	1,810	
Primary Ilmenite	US\$/t	310	
<b>Overall Heavy Mineral Conc Price</b>	<b>US\$/t</b>	<b>403</b>	80% Zr
...% Zr in HMC Price	%	81%	
<b>Rare Earth Conc Price</b>	<b>US\$/t</b>	<b>11,000</b>	
(driven by neodymium & praseodymium prices)			
FX	AUD:USD	0.70	
<b>Avg Total Revenue</b>	<b>\$m</b>	<b>298</b>	
Rare earths % of revenue	%	47%	Stage 1 3rd party processing
<b>Total Capital Required Stage 1</b>	<b>\$m</b>	<b>400</b>	Debt, prepayments, equity
Target debt level	%	65%	
<b>Discount rate</b>	<b>%</b>	<b>10%</b>	
Cost of equity	%	15%	
Cost of debt (pre tax)	%	10.0%	
Tax rate	%	30%	
<b>NPV Donald Project Stage 1</b>	<b>A\$m</b>	<b>412</b>	Only using 17% of Resource
NPV per share	A\$/share	3.09	
IRR	%	28%	
Royalty rate	%	2.75%	Victorian State Govt
Overall cost per tonne of ore mined	A\$/t	24.0	

Valuation key sensitivities		
10% change in zircon price	change in NPV	18%
10% change in RE concentrate price	change in NPV	19%

Capital Required - Donald Project		A\$m
Capex Stage 1		350
Working Capital		50
<b>Total Capital Required Stage 1</b>		<b>400</b>
Target debt level		65%
<b>Target debt</b>		<b>260</b>
Debt: Offtake prepayments		60
Debt: Project and bank debt		200
<b>Equity Required</b>		<b>140</b>
As % of current mkt cap		148%

Source: Total Capital from Astron, rest PAC Partners estimates

Model assumes 2 stage raising		A\$m	Price	Shares
FY24	55%	77	0.71	108.5
FY25	45%	63	0.71	88.7
<b>Total Equity for Stage 1</b>	<b>100%</b>	<b>140</b>		<b>197.2</b>
Existing shares				133.2
<b>Total shares</b>				<b>330.4</b>
Potential increase in share count under scenario				148%

Source: PAC Partners estimates

## KEY POINTS

The Donald Project was last slated for development in 2014-17 but key developments in processing, rare earths demand and zircon supply challenges means the opportunity for Donald again presents itself.

Processing technology, specifically spiral processing, has developed to enable the successful economic extraction of finer grained mineral sands.

Uranium and thorium levels are becoming less of a concern and customer offtake agreements shall be crucial in addressing this risk.

A looming zircon supply gap provides the opportunity for Donald Project to become an industry mainstay.

### Fine grained mineral sands projects have been largely passed over historically due challenges separating the valuable minerals. How has this changed?

- The ability to extract valuable minerals from finer grain mineral sands saw a breakthrough with the FM-01 Spirals developed in the 2000s by Mineral Technologies (spirals operate at slower speed to minimize turbulence).
- The MG-12 Spirals are the latest iteration of this technology improving further on efficiency and enabling the processing of additional materials in the 20-38 micron fraction.
- Overall this has made the economic recovery of elements within finer mineral sands possible and Astron has recently updated their resource statement to include valuable minerals within this particle size range for the first time.
- The MG-12 Spirals are currently used by
  - Chemours (NYSE: CC) at the Southern Ionics Mission South Wet Concentrator Plant; and
  - Sheffield Resources (SFX) at the Thunderbird Project (in construction with first shipment expected Q1 2024).

### Rare earth product stream did not exist in previous plans. What has changed?

- The critical minerals era is upon us and this contrasts significantly to the prior period in which Donald was put forward for development on the back of its mineral sands output only.
- Donald is one of the few long life and importantly scalable new sources of monazite supply. This source of supply is set to commence just as Western Countries are focusing efforts on boosting critical mineral supply chains. Rare earths are expected to comprise 50% of revenue in the first 5 years of mining.

### Uranium and thorium levels have been a concern for deposits such as the Donald Project. What has changed?

- The historical threshold for uranium and thorium levels in zircon has been 500ppm. However the market is moving towards higher tolerance of uranium and thorium levels as most of the material below this threshold has been exhausted and there is less zircon used per product manufactured.
- Sheffield's Thunderbird and Kalbar's Fingerboards, are planning to produce products with similar radioactivity levels to the Donald Project.
- China market can handle Donald levels of uranium and thorium: The uranium and thorium limit for zircon in China is 10Bq/g. The Donald Project, zircon has a combined U+Th of 700~800ppm, roughly equivalent to 6Bq/g, well below the limit.
- Europe: There has been a perceived cut-off of 500ppm in Europe, limiting the possibility of marketing Donald output in this region.

### Zircon was previously in oversupply – what gives confidence of a zircon supply gap?

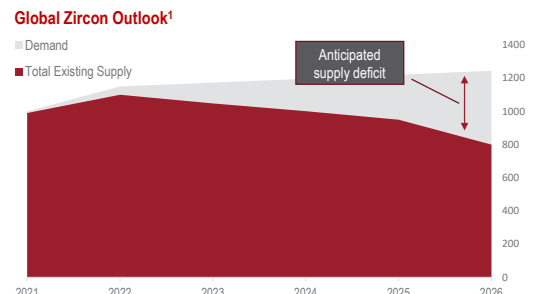
- In the period from 2013, Iluka's Jacinth-Ambrosia (JA) Mine more than satisfied global zircon demand and capped prices.
- However, the global market is set to see a drop in zircon supply within 2 years due to JA mine depletion providing a potential market window of opportunity for Astron to now sign offtake agreements to underpin the Donald Project development.

Figure 5: Zircon market heading for deficit



Note: Historic pricing graph is based on Astron commissioned RuiDow report and publicly available data from ruidow.com. The price trend shown is reflective of premium zircon prices as defined by zircon products with ZrO<sub>2</sub> > 66%, C.I.F. to China.

Source: Astron Presentation Dec 2021



1. Compiled internally by Astron Corporation, based upon publicly available information, and various market studies, including Ruidow report Aug 2021 commissioned by Astron.

## KEY POINTS

Project is located 300km north-west of Melbourne.

The Donald Project is a Wimmera-style (WIM-style) deposit.

Western Victoria is a relatively remote and rural area that would welcome investment.

The Donald Project is located 300km north-west of Melbourne, and comprises:

- The Donald Deposit to the north, and
- The Jackson Deposit to the south.

The two deposits are 10-20km apart.

The deposits are a result of heavy mineral sand accumulation via the ancient Murray Basin sea. The Donald Project is a Wimmera-style (WIM-style) deposit characterised by a lower grade but larger deposit. WIM-style deposits tend to have sheetlike geometry, lower grade but higher tonnage. This is opposed to Strandline heavy mineral sands deposits that are typically higher grade and lower tonnage and have been more likely to have been developed in recent decades compared to WIM-style deposits.

The two tenements (MIN5532 and RL2002) span approximately 42,600ha (426km<sup>2</sup>) over land that has for the most part, been cleared and currently used in cropping/grazing (Astron itself owns several of the properties in the area).

Figure 6: Donald Mineral Sands project located in 300km north-west of Melbourne, Port Headland is an existing mineral sands export facility



Source: Astron website

Astron has a long history of successful operations in mineral sands including the zircon processing business in China that was sold for \$220m in 2007.

The Donald Deposit was discovered by Rio Tinto's predecessor company CRA.

## HISTORY OF THE DONALD PROJECT – PURCHASED FOR \$11M

- The Donald deposit was discovered by CRA in the 1985, and sold by CRA after its integration with Rio Tinto as the company wanted to focus on titanium dioxide dominant deposits rather than zircon focused deposits.
- Astron listed on the ASX in 1983 with zircon sales, marketing and chemical product processing assets in China.
- In 1992 the company established the import/export of zircon sand into China.
- Astron bought the Donald Project from Zirtanium Pty Ltd in 2004 for A\$11m.
- In 2007, Astron sold its China zircon assets to a French mineral sands processing group for €121m/A\$220m
- In 2010 the company secured the Stage 1 mining license for the Donald Project.
- In 2013 Astron released a DFS with an NPV A\$2.1bn, after A\$518m in CapEx.
- In 2014, Astron signs EPS framework contract with CMEC of China to develop the Donald Project but this lapses in mid-2018 when conditions precedent unable to be satisfied due to challenging market conditions including lower than required global zircon prices.
- In 2019 following the passing of company founder Mr Alex Brown, Tiger Brown is appointed executive director, and in 2021 Tiger is appointed Managing Director.
- In 2020 and 2021, significant piloting test works were conducted to enhance the project design including confirming the ability to produce a rare earths concentrate from froth floatation techniques, and ability to produce a premium (whiteness) zircon product.

## KEY POINTS

The Donald Project resource is globally significant within the industry for not only sheer size and contained zircon, but also for its rare earths in monazite and xenotime.

The Donald Project comprises

- The Donald Deposit to the north, and
- The Jackson Deposit to the south.

The two deposits are 10-20km apart and it is proposed the Donald Deposit shall be developed first.

Figure 7: Mineral Resource – stated in both % of ore and absolute volume. The Project is one of the largest of its type on ASX

Donald Project Mineral Resource	Mt	Slimes %	Oversize%	HM%	Ilmenite (%HM)	Leucoxene (%HM)	Rutile (%HM)	Zircon (%HM)	Monazite (%HM)	Xenotime (%HM)
Min5532	525	18%	10%	4.0%	21%	23%	7%	16%	1.9%	0.7%
RL2002	1,286	16%	9%	4.8%	33%	18%	8%	18%	2.0%	
<b>Donald Deposit Total</b>	<b>1,811</b>	<b>16%</b>	<b>9%</b>	<b>4.6%</b>	<b>30%</b>	<b>19%</b>	<b>8%</b>	<b>18%</b>	<b>1.9%</b>	
Jackson Deposit	823	18%	5%	4.8%	32%	17%	9%	19%	2.0%	
<b>Total</b>	<b>2,634</b>	<b>17%</b>	<b>8%</b>	<b>4.6%</b>	<b>31%</b>	<b>18%</b>	<b>8%</b>	<b>18%</b>	<b>1.9%</b>	

Donald Project Mineral Resource	In-Situ:	In-Situ HM (Mt)	Ilmenite (Mt)	Leucoxene (Mt)	Rutile (Mt)	Zircon (Mt)	Monazite (Mt)
Donald Deposit		82.7	24.8	15.7	6.6	14.9	1.6
Jackson Deposit		39.5	12.6	6.7	3.6	7.5	0.8
<b>Total</b>		<b>122.2</b>	<b>37.4</b>	<b>22.5</b>	<b>10.2</b>	<b>22.4</b>	<b>2.4</b>

Source: Company Announcement 2022

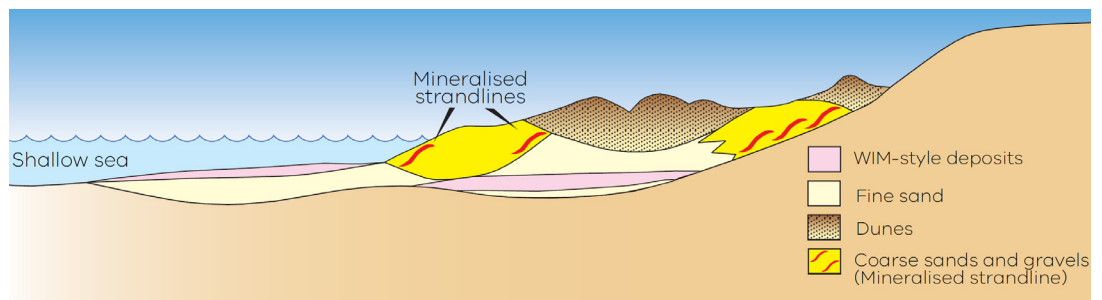
Figure 8: Ore Reserves across the Donald Deposit (due to be updated Q1 2023 following Resource update already released)

Donald Project Ore Reserves	Mt	Slimes %	Oversize%	HM%	Ilmenite (%HM)	Leucoxene (%HM)	Rutile (%HM)	Zircon (%HM)	Monazite (%HM)
ML5532	194	14.1%	12.0%	5.3%	31.6%	22.0%	7.0%	19.0%	1.9%
RL2002 (within RL, outside ML)	408	16.9%	11.9%	4.5%	31.8%	19.0%	8.4%	18.8%	1.8%
<b>Total</b>	<b>602</b>	<b>16.0%</b>	<b>11.9%</b>	<b>4.8%</b>	<b>31.7%</b>	<b>20.1%</b>	<b>7.9%</b>	<b>18.8%</b>	<b>1.7%</b>

Donald Project Ore Reserves	In-Situ	HM (Mt)	Ilmenite (Mt)	Leucoxene (Mt)	Rutile (Mt)	Zircon (Mt)	Monazite (Mt)
ML5532			10.3	3.2	2.3	0.7	2.0
RL2002 (within RL, outside ML)			18.4	5.8	3.5	1.5	3.5
<b>Total</b>			<b>28.9</b>	<b>9.2</b>	<b>5.8</b>	<b>2.3</b>	<b>5.4</b>

Source: Company Announcement, Feb 2021

Figure 9: WIM Style Deposits (such as Donald) are wider and thinner than strandline deposits that have been more commonly developed



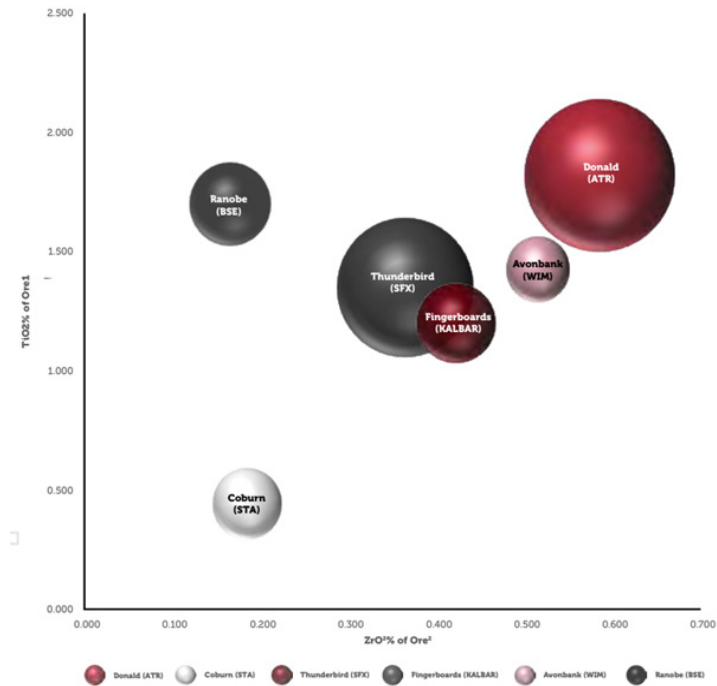
Source: Mineral Exploration in Victoria, earthsources.vic.gov.au and originally from Base Resources.

## KEY POINTS

The Donald Project has industry wide significance as indicated by the resource size (represented as bubble size).

The Donald Project has both relatively high zircon and high titanium dioxide in its ore.

Figure 10: Donald Project enjoys significant size



Source: Astron Annual Report FY22

The metallurgy of the project has been subject to significant test work since 2019 including the successful production of a rare earth concentrate.

Extensive met test work has been conducted ahead of feasibility study revisions.

## METALLURGY

Since 2019 Astron has undertaken metallurgical testing and pilot scale production of Donald Mineral Sands material. In 2020 and 2021, significant piloting test works were conducted to enhance the project design including confirming the ability to produce a rare earths concentrate from froth flotation techniques, and ability to produce a premium (whiteness) zircon product.

As part of this work, 1,000 tonnes of ore were processed through a Wet Concentrator Plant to produce 24 tonnes of Heavy Mineral Concentrate.

Subsequently this Concentrate was run through pilot scale floatation plant to produce a rare earth concentrate.

This work has been further enhanced in 2022 and optimised for zircon and rare earth recoveries.

Figure 11: Recoveries of valuable minerals at various stages of pilot plant testing

Recoveries at various stages Assemblage	Recoveries at various stages			
	FPP	WCP	CUP	Total
TiO <sub>2</sub>	98.1%	70.7%	99.2%	~75%
ZrO <sub>2</sub>	96.9%	94.3%	99.0%	>88.9%
CeO <sub>2</sub>	97.9%	94.5%	96.5%	>85.8%

FPP Feed Prep Plant  
WCP Wet Concentrator Plant  
CUP Concentrate Upgrade Plant

Source: Company Announcement August 2022

# THE DONALD PROJECT - DEVELOPMENT STRATEGY - PHASED...

## KEY POINTS

Execution of the Donald Project has now been broken down into a phased approach.

Phase 1 should see output of 250ktpa of Heavy Mineral Concentrate and 9ktpa of a Rare Earth Concentrate.

Total Capex for Phase 1 is estimated to be \$350-\$400m.

Phase 2 is envisaged to be a doubling of Phase 1 production, but importantly will potentially tie into Australia's critical mineral strategy by investigating the opportunity to process rare earths concentrate locally.

Given the scale of the Donald Project, a staged development approach has been chosen.

This reduces the capital cost compared to previous plans and will give Astron flexibility to fine-tune processing, mining and downstream offtakes.

A revised feasibility study is due in 1H 2023, but the overall revised framework has been set out:

### Phase 1: FY25... 7.5Mtpa

- 7.5Mtpa of mining and ore throughput for average Phase 1 production of two concentrate product streams
  1. **250ktpa** of Heavy Mineral Concentrate
  2. **~8ktpa** of Rare Earth Element Concentrates.
- These rates of production could be sustained for ~35 years.
- Development capex range of ~A\$350 to A\$400m.
- Mining strip ratio of 1.9:1 in the first 4 years of production, and 2.2:1 for the subsequent 31-years of production.
- Concentrates are to be trucked from site to the intermodal facility located in the Wimmera, and railed to ports.

Production of the final products (zircon and titania HM products, and the constituent rare earths) is to be done off-site by third-party separation facility or for HMC could be conducted at Astron's own separation plant in Yingkou in China (or a combination of these two).

The previous iteration of the development involved producing a HMC only (i.e. no focus on the rare earth components), and processing this onsite into zircon and titania end products.

This is a scaled back mining plan and ore feed into processing plant compared to 12.5Mtpa previously and eliminates the previously planned on-site Mineral Separation Plant (comprising a Wet High Intensity Magnetic System (WHIMS) plant and a dry separation plant). It also results in a smaller overall infrastructure footprint and confines mining operations of the Donald Mineral Sand project to MIN5532.

We view this as a far more executable project and it aligns with the requirements of the already in place Environmental Effects Statement (EES) from the Victorian State Government and maximises the ease of obtaining the required Work Plan approval prior to project commencement.

Figure 12: Revised development plan

Table 1. Indicative Production Profile For Phase 1 Operation		
	Avg. of first 5 years	Avg. over life of Phase 1
<b>On-Site Products</b>		
<b>REEC</b>	~9 ktpa	~8 ktpa
<b>HMC</b>	~285 ktpa	~250 ktpa

Source: ASX Announcement 18 August 2022

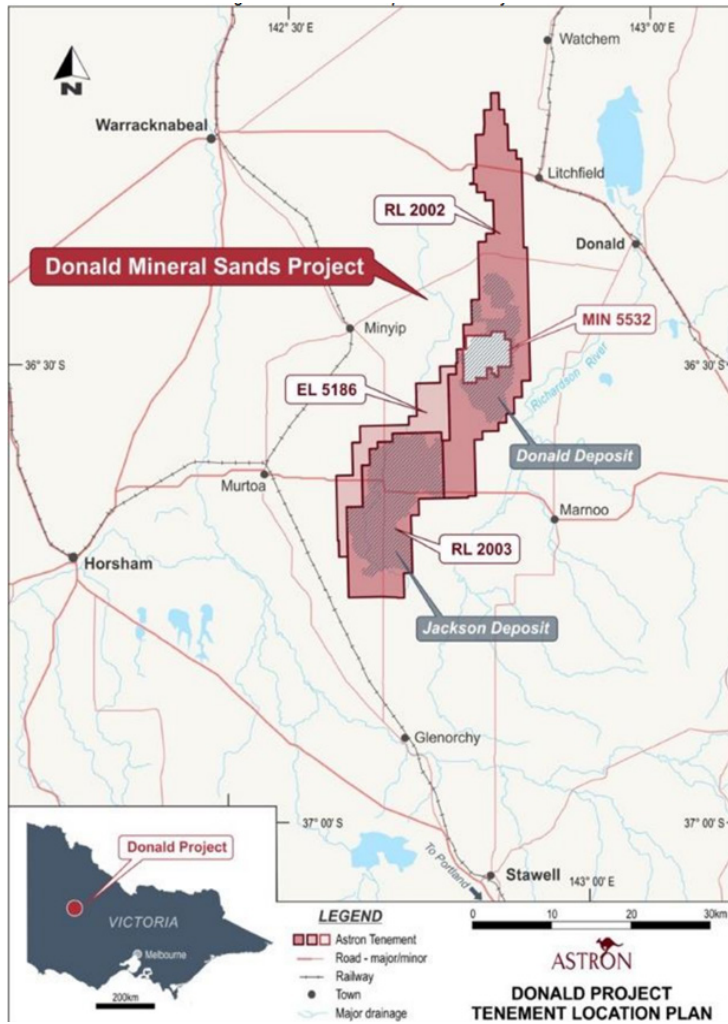
### Phase 2 FY27+ doubling to 15Mtpa

- 15Mtpa Ore mining rate, to produce:
  - 17ktpa of REEC and
  - 500ktpa of HMC.
- On-site mineral separation to produce final products (Zircon and Titania), capturing a larger portion of the ultimate end product value.
- Phase 2 will also evaluate secondary rare earth concentrate processing options locally.

### Phase 3 FY30+ larger...

- Potentially further increase throughput,
- Rare earth processing (cracking),
- Second mine path (replicating facilities and processes).

Figure 13: Donald Project: Phase 1 is to be contained within boundaries of MIN5532, while Phases 2 and beyond utilize areas RL 2002 and RL 2003 and subject to necessary regulatory approvals



Source: ASX Announcement 18 August 2022



## KEY POINTS

Separation of the valuable minerals from the ore will occur via Wet Concentrator Plant and then split into Heavy Minerals and Rare Earth streams via a Concentrate Upgrade Plant.

Long term water rights were secured back in 2012.

The Donald Project is located in a rural setting with population centres within 30mins drive.

## PROCESSING AND CONCENTRATING

Gravity Separation and a Wet Concentration Plant (WCP) separate the Valuable Heavy Minerals and rare earths from the mined ore.

Subsequently the Contrate Upgrade Plant (CUP) separates the rare earths from the zircon and titania concentrates via floatation.

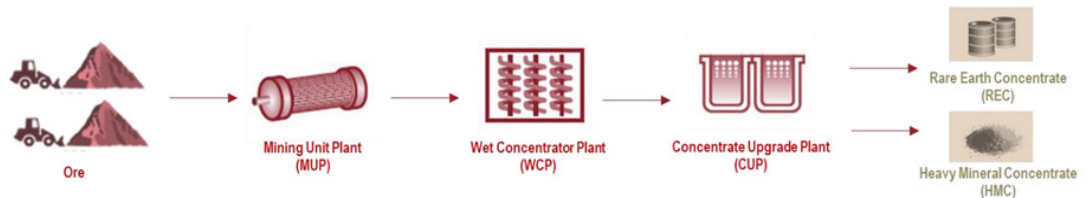
REEC is sold to other parties and the HMC is transported to containers in Victoria for bulk export via port.

The company will explore the potential to absorb further value by vertically integrating a larger proportion of the refinery process. If it is feasible to separate the HMC on-site, Astron has identified the need for a Dry Mineral Separation Plant (including magnetic and electrostatic separation equipment) which would be subject to additional regulatory approval.

The company will explore this only once Phase 1 has begun and is up and running.

The concentrate is expected to have a **natural radioactivity of under 9 becquerel/gram (Bq/g)**, and will be able to be transported under Victorian Government regulatory arrangements and exported to key markets. Is this still true?

Figure 16: Revised flowsheet removes on-site processing, reduces processing footprint and capital cost



Source: ASX Announcement 18 August 2022

## SERVICES AND INFRASTRUCTURE

**Water – rights have been secured.** The project area is generally dry and not subject to significant rainfall. Water rights for Phases 1 & 2 have been secured. Water Rights include a 6.975 gigalitre water 25 year entitlement purchased from Grampians Wimmera Mallee Water in 2012 for A\$17m, sufficient for both Phase 1 and Phase 2. Astron has the option, subject to the approval of Grampians Wimmera Mallee Water, to extend this for another 25 years. The contract for the water rights included a fee of \$220,000 per quarter for the life of the water rights. Water security of supply in the area was boosted significantly with the completion of the Wimmera Mallee Pipeline in 2010.

The Parilla Sand hosts the main groundwater aquifer in the project area but high salt content and low yield (volume) means the groundwater is not subject to high demand.

**Grid power access** – electricity supply from the transmission grid. Key power source is Horsham Terminal Station and substation located near the mine site.

**Transport via road/rail to port** – Concentrate product is to be transported to port either by road or a combination of road and rail. An extensive rural rail and road network exists in the area to support grain transportation. The ports of Portland, Geelong and Melbourne are all within approximately 300km of the project.

**Proximate to employment populations** – the regional townships of Horsham (circa 20,000 population) and Stawell (6,000) are around 30mins drive from the project providing potential employment opportunities for these populations. Donald and Minyip are the closest settlements with small populations of circa 1,400 and 500 respectively per 2021 census data.

Figure 17: Key metrics as released by Astron

Key Metrics <sup>2</sup>		
<b>Revenue<sup>3</sup></b>		<b>A\$286m p.a.</b>
REEC (50%)		A\$143m p.a.
HMC (50%)		A\$143m p.a.
<b>Capital Expenditure</b>		~A\$350m
<b>Total Capital Requirement</b>		~A\$400m
Indicative Production Profile For Phase 1 Operation		
On-Site Products	Avg. of first 5 years	Avg. over Phase 1
REEC	~9 ktpa	~8 ktpa
HMC	~285 ktpa	~250 ktpa

2. See ASX Announcement 18 Aug 2022, Donald Project Configuration Update  
3. Revenue estimated using assumed AUD/USD rate of \$0.70.

Source: Company Presentation October 2022

Rare earth stream to represent around 50% of total revenue highlighting the importance of rare earths to the revised project economics

## REVENUE COMPOSITION

Following the strength in the rare earth market, the company now expects their rare earth product (REEC) to contribute approximately 50% of revenues in Phase 1. The HMC product therefore makes up the remaining proportion of revenue, and is further divided as zircon is expected to contribute towards 80% of HMC revenue and titania products are expected to contribute just 20%.

An average annual revenue of US\$200m is used to break this down as follows:

- REEC: US\$100m
- Zircon: US\$80m
- Titania: US\$20m

We use FX rate AUD:USD 0.70 in our model.

Figure 18: Key Donald Project variables

Parameter	Unit / Description
<b>Mine Type</b>	Open pit
<b>Mining Method - Ore</b>	Conventional Truck and Shovel
<b>Mining Method - Overburden</b>	Conventional Truck and Shovel
<b>Mining Rate - Ore</b>	7.5 Mtpa
<b>Mining Rate – Overburden</b>	To suit ore
<b>Strip ratio</b>	2.2:1
<b>Products</b>	Heavy Mineral Concentrate (HMC) Rare Earth Element Concentrate (REEC)
<b>Mineral Recoveries</b>	HM to HMC: 62.9% RE to REEC 85.8%
<b>Production HMC</b>	250-300 ktpa
<b>Production REEC</b>	7-10 ktpa
<b>Product Transport</b>	Road and Rail
<b>Product Price Basis</b>	Free On Board (FOB) Melbourne Port

Source: Company ASX Announcement 18 August 2022

## KEY POINTS

In addition to the core Donald Project, Astron has other assets in China, Senegal and to a lesser extent a financial claim in Gambia.

Astron used to have a significant zircon processing business in China until it was sold in 2008 for a significant sum.

China operations now comprise smaller but still significant mineral sands processing and trading operations with revenues in FY21 of \$18m.

One long term option is to integrate Astron's China processing and its Australian mineral sands production assets.

Apart from the Donald Project, Astron Limited also owns other global assets:

1. In China... Mineral sands processing and trading assets in China,
2. In Senegal... The undeveloped Niararang Mineral Sands Project, Senegal, and
3. In Gambia... A ~\$33m contingent asset (Judgement Award against the State of Gambia).

### CHINA MINERAL SANDS PROCESSING AND TRADING

Astron's Chinese plant currently operates as a mineral sands processing and trading operation for middling grade heavy mineral concentrate (HMC). The legal entity housing the operation, Astron Titanium (Yingkou) Company Ltd, is a Chinese domiciled company.

Astron's Chinese operations are located in north east China at coastal city of Yingkou and comprise:

- Speciality mineral separation plant, and
- Titanium and micro-agglomeration plant.

The Yingkou plant is one of the largest rutile mineral separation facilities in China and started production in 2019 after construction commenced in April 2018. The plant relies on lower grade TiO<sub>2</sub> HMC feedstocks purchased on the global market to produce artificial rutile.

The artificial rutile is then used as a high-quality feedstock in the chlorination production process in TiO<sub>2</sub> powder production plants in China.

While current Phase 1 capacity is 150 ktpa for final production of ~50 ktpa rutile, it has been built with an ultimate potential capacity to process 300 ktpa HMC / 100ktpa rutile.

The plant has the capability to produce nuclear grade zirconia.

Astron also maintains trading and sales presence in Shenyang, a major city ~200km inland from Yingkou.

The China operations turn over around A\$19m in the most recent financial year and were said, by the Directors, to be cash neutral despite the difficult trading conditions (COVID shutdowns amid commissioning of a new zircon middling process plant) and overall segment loss was A\$3m. We note in quarterly disclosures, the Chinese operations carry around A\$12m in debt facilities to support trading and this is lent against land holdings and personal guarantees.

Figure 19: Astron's Chinese operations have grown significantly since 2018

Operating Division A\$	FY18	FY19	FY20	FY21	FY22
<b>China (Titanium &amp; Mineral Resources)</b>					
Sales (of mineral products)	5,013,827	7,977,198	8,430,039	16,418,037	18,999,516
Interest Revenue	11,335	13,356	1,429	7,873	3,256
Rent & Other Income	280,570	69,022	124,053	1,476,054	67,052
<b>Total Revenue &amp; Other Income</b>	<b>5,305,732</b>	<b>8,059,576</b>	<b>8,555,521</b>	<b>17,901,964</b>	<b>19,069,824</b>
Segment Net Operating Profit	(2,900,793)	(1,521,736)	(4,757,811)	1,195,021	(3,049,295)
Impairment	0	0	0	0	
CapEx	2,688,963	4,293,960	1,293,631	1,002,331	507,645
Depreciation & Amortisation	689,126	837,341	1,639,837	1,578,022	1,660,983

Source: Company Results Announcements

**Possible longer term Australia-China integration of Astron's assets... does not seem a current priority.** For Astron's Donald Project mineral sands concentrate to be processed through the company's existing Chinese facilities, we understand the Chinese plant would have to be significantly reconfigured and capacity doubled (approximately).

While a fully integrated operation offers the advantage that the processing facilities can be tailored to the mine output, particularly as mine output evolves over time, and offers more control to the mine operator in addition to capturing the value added component, we do not see Astron in a position currently to fund the redevelopment / reconfiguration of the Chinese processing plant to facilitate this.

## KEY POINTS

The Senegal Mineral Sands project is significantly smaller than The Donald Project and remains on hold following local unrest.

However it remains a long term viable development asset for the company.

We do not expect any near term move to develop the Niafarang deposit while Donald remains the key development focus for the company.

The company also has a financial claim in Gambia that is still subject to recovery efforts.

## SENEGAL – THE UNDEVELOPED NIAFARANG MINERAL SANDS PROJECT

Astron holds the mining licence to a coastal zone of ~400 square kilometres along a 75km stretch of the Casamance coast of Senegal. This includes the Niafarang mineral sands project, located in the northernmost 6km of the licence area, that is much smaller than the Donald Project but still a potential valuable project in the longer term.

According to Astron, the mineral sands deposit has been delineated and contains coarse grained ore capable of producing high grade ilmenite and zircon. The planned mining approach involves conventional dry mining techniques with nearby concentrating and sale of concentrate to a toll processor. Both the required environmental approval and mining licence were granted in 2017 for the project. However, the project was suspended in 2020 due to local unrest. The mining equipment for the project is under storage in Dakar. Astron has been progressing talks with regulators about navigating a path to developing the project with one possibility being a Public Private Partnership. During FY22, the company submitted applications for renewal of mining licenses. These approvals allow the company to progress planning and drafting a timeline for the Niafarang Project. Once all the negotiations have taken place and approvals are once again in place, Astron is confident that production is able to commence relatively quickly, with a minimal capital expenditure requirement.

Figure 20: Niafarang (Senegal) project restarts development/exploration



Source: Company Report

### Key data for Naifarang Project:

- Based on a 2017 Mineral Resource estimate, the planned Stage 1 mining operations will access 4.8mt of ore bearing sand, with an average heavy mineral (HM) grade of 12.5%.
- Assemblage characteristics: ilmenite 75%; zircon 13.7%, rutile 2.3%. 12.4% heavy minerals.
- Production from Stage 1 is estimated at ~15ktpa of zircon and ~80ktpa of ilmenite, with a total 5 year mine life.
- Heavy mineral concentrate will be produced for processing into final products of zircon, rutile and ilmenite in China.
- Exploration to extend mine life will occur during stage 1.

## GAMBIA ~\$33M CONTINGENT ASSET

Astron was awarded damages in its favour in 2015 associated with an International Centre for Settlement of Investment Disputes (ISID) determination related to the Gambian Government's seizure of the Astron Carnegie minerals sands project in Gambia.

The initial award was in the vicinity of ~A\$32 million. Progress has been slow in recovering the award, but the Company continues to utilise a global legal firm to seek recovery of its entitlement.

## KEY POINTS

ESG will be an important aspect for Astron and the Donald Project development.

The Donald Project enjoys community support in a rural area that would welcome significant investment.

Long term we see opportunity for governance to be further strengthened as the Donald Project comes closer to fruition and the economic resources of the company are greater.

Astron is an ESG aware company placing significant emphasis on aspects of ESG as it progresses towards development of the Donald Project.

In March 2022, the company appointed a Community Liaison Officer and held a number of public information sessions to keep the community abreast of its development plans for Donald. A Community Reference Group has also been established which is to act as an avenue for the community to provide feedback to the company and facilitate the flow of information.

Astron company has also committed to hire locally from the community which should be of particular benefit given the relatively lower levels of economic activity in the region compared to previous decades. The project has been assessed in recent Economic Impact Assessment to contribute **150 direct** and **536 overall** new full time equivalent jobs in the area during Phase 1.

To this end, on 24-Nov-2022 the company signed an updated Memorandum of Understanding with the Yarriambiack Shire Council, who plays host to the Donald Project. The MoU focuses on areas of collaboration between the parties including:

- Optimising economic and social outcomes – so as to facilitate as many positive outcomes as possible from the project while also minimizing and mitigating any potential negative employment and social outcomes associated with the project; and
- Building relationships to support the Donald Project – working cooperatively on advocacy and relationship management so as to aid in the timely delivery of the project.

In 2021, the company proposed a demerger with it's China asset (Yingkou) which was supported at an EGM. However the plan was shelved later due to a court injunction in Hong Kong brought by a shareholder with 15k CDIs (worth around A\$6k).









### Governance – an independent board alongside major shareholder

Astron has a board of 5 Directors including an independent Chair, and a majority of independent directors. The MD Tiger Brown and Executive Director Kang Rong are the majority shareholders and related to the founder of the company who passed away in late 2019.

### Management – boosting ranks as project readiness nears

The most recent appointment to the executive ranks has been CFO Greg Bell who brings direct mineral sands industry experience from his time at Mineral Deposits Ltd.

Figure 21: Astron Limited - Board and Management

 <p><b>George Lloyd</b> Chairman</p> <p>George has 30 years resource industry and corporate business development and finance experience, including with RGC Limited, as well as serving as a senior executive and director of a number of listed and unlisted companies with interests in industrial minerals, base and precious metals, as well as energy sector.</p>	 <p><b>Tiger Brown</b> Managing Director</p> <p>Tiger joined Astron in 2018, holding various business development planning and executive roles in China and Australia prior to joining the board in 2019. Appointed managing director in February 2019 and has overseen the detailed planning for the commercialisation of the Donald project.</p>
 <p><b>Gerard King A.M.</b> Non-Executive Director</p> <p>Gerard is a former partner of Lavan &amp; Walsh, which became Phillips Fox Perth. Experienced in commercial contracting, mining law and corporate and ASX compliance. A former member of the Australian Mining &amp; Petroleum Lawyers Association Served as a non-executive director for several companies.</p>	 <p><b>Sean Chellus</b> Donald Project Director</p> <p>Sean joined Astron in January 2022 as the Project Director for the Donald Mineral Sands and Rare Earth project. Sean has over 30 years international experience in mining project planning and implementation, including full responsibility for taking projects from concept through to commissioning and production. His experience involves project management and engineering roles in Australia, South Africa, Zimbabwe, Papua New Guinea and Fiji with BHP, Anglo American, Newcrest, Ausenco and Worley Parsons.</p>
 <p><b>Dr Mark Elliott</b> Non-Executive Director</p> <p>Mark has 27 years experience in corporate roles, both as chairman and managing director on several ASX-listed and private companies. Involved in identifying and securing resource projects, capital raisings, marketing and completing commercial agreements, feasibility studies, mine development plans and their execution.</p>	 <p><b>Greg Bell</b> Chief Financial Officer</p> <p>Greg's advisory and corporate experience spans more than 21 years, working initially in corporate advisory and assurance services with Deloitte, followed by 8 years with Mineral Deposits Limited (MDL) as Accounting Manager and then Chief Financial Officer. Subsequent to MDL, Greg held both consulting and executive roles with international mineral sands and resource companies, including in the critical minerals sector.</p>
 <p><b>Rong Kang</b> Executive Director</p> <p>Rong joined Astron in 1995 and has been a key contributor to the establishment of Astron's downstream processing and global marketing and sales activities, with a deep knowledge of the mineral sands product market and its key participants. Board member since 2012.</p>	 <p><b>Tim Chase</b> General Manager Global Operations</p> <p>Tim joined Astron in 2015 with over 25 years of experience in the mining industry, including extensive experience in mineral sands project design and planning, project management and execution, as well as operational roles. He was involved in the design and commissioning of several mineral sands projects in the Murray Basin, Victoria and NSW.</p>

Source: Astron Corporate Presentation October 2022

## KEY POINTS

Key risks are generally typical of a commodity development project.

Zircon and rare earths prices are the key market risks.

The State of Victoria is known for its challenging approval regime for mining projects but the project is located in a lower risk, lower populated regional area that would welcome significant investment.

Shareholder concentration poses its challenges at this early stage but we do expect significant potential dilution of the major shareholding as equity capital is raised towards Donald Project development.

## RISKS FOR ASTRON INCLUDE AND ARE NOT LIMITED TO THE FOLLOWING:

### Commodity price risk

- **Zircon price:** The Donald Project is set to be a major global producer of zircon once fully developed and one of the key reasons the project did not proceed in the prior iteration to be developed was low global zircon prices. A gap in the market is due to open up as major industry producer Iluka sees its Jacinth Ambrosia mine approach end of mine life.
- **Rare earths prices:** With 50% of Donald Project revenue to be generated from rare earth product stream, a significant downturn in rare earths prices, specifically in minerals monazite (containing neodymium and praseodymium) and xenotime (containing dysprosium and terbium) would negatively impact project economics.

### Available Debt and Equity Capital

- Astron has been clear in its market communication that it will need to raise a significant amount of debt and equity capital to underpin Donald Project development. To the extent the company can not raise sufficient capital it would put the project at risk and potentially negatively impact the value of the company. We do expect to see some dilution of the major shareholder as capital is raised.
- The Donald Project may also attract some capital grants from Governments or Government agencies, and/or attractive offtake contracts which once locked in can further facilitate raising of subsequent debt and equity funding.
- We expect 2023 to be the year where offtake contracts and capital discussions and initial capital raising to take place. It may continue into 2024 given the significant amount of capital that will need to be raised.

### Regulatory risk

- Astron's Donald Project is located in the state of Victoria which is generally known for its robust regulatory approvals. However most of the required approvals for the Donald Project were granted as far back as 2008.
- Victorian Government Work Plan – This is the key outstanding approval. Regulatory personal have recently visited the mine site (in Dec-Qtr 2022). Groundwater modelling, surface water management, and radiation management are key aspects of on-going work to support the Work Plan application to be submitted in mid-2023. Once received shall be a significant step forward for the project.
- Victorian Environmental Effects Statement – was granted in 2008 and project has been aligned with the approvals already in place. We understand there to be no expiry on this approval.
- Radiation licence – granted in December 2020 expires in December 2023. Radiation licence and export permit were issued in 2014 and 2016 and have been renewed as required by the company. The export permit shall need to be finalised according to the final product specifications the company proposes in its final feasibility study and customer offtake contracts.

**Project development risk** – once a Final Investment Decision has been taken, project development risk shall need to be managed.

### A concentrated share register

- **Company control:** 72% of shares are held by one party (MD Tiger Brown) who's interests, while currently do not in our view, may diverge from those of minority shareholders.
- **Share liquidity risk:** The company's shares lack a significantly liquid market given the concentration in share ownership.
- Contrasting with these elements are signs that the major shareholder offers willing to take a reasonable view of participation and increase liquidity as demonstrated in the latter part of 2022 when shareholding was lowered from 77% to 72% during the placement and share purchase plan process.

## KEY POINTS

We see significant upside for the share price as the Donald Project comes closer to development and share liquidity improves.

We value Astron at over \$400m or near \$3.08/share based on the outline of the current development plans for Stages 1 and 2.

Figure 22: Astron Limited: Valuation

Astron - Valuation	IRR	A\$m	A\$/share	
Donald RE & MS (St 1)	28%	412	3.09	96%
China processing plant		13	0.10	3%
Senegal Niararang MS Project		2.5	0.02	1%
Contingent (Gambia A\$33m)		1.0	0.01	0%
Corporate and other		-	-	
<b>Sub Total</b>		<b>428</b>	<b>3.21</b>	<b>100%</b>
Net debt		17	0.13	
<b>Potential Equity Value</b>		<b>411</b>	<b>3.08</b>	<b>334%</b>
WACC used			10%	
Shares used (million)			133.2	

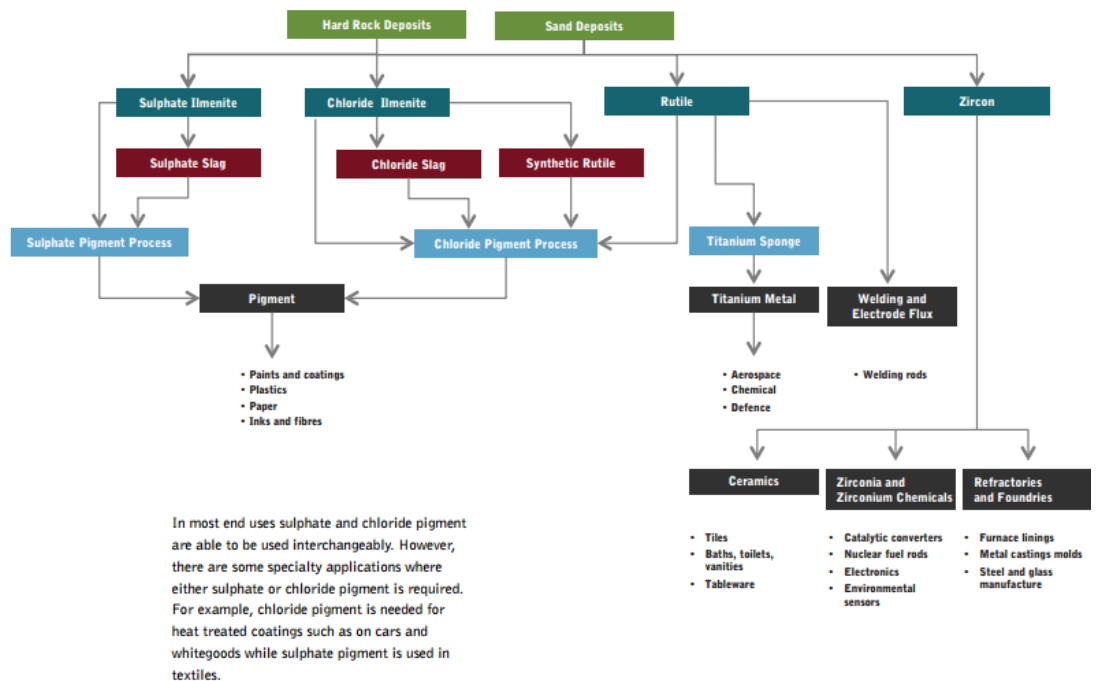
Source: PAC Partners Analysis

The valuation model is most sensitive to zircon and rare earth prices, where 10% changes in either would affect the valuation by ~18%.

## MINERAL SANDS INDUSTRY – PRODUCT AND END USE OVERVIEW

Donald Project is overwhelmingly a Zircon dominant deposit. Zircon is mainly (50%) used in ceramics.

Figure 23: With the development of Donald, Astron will be a zircon (plus rare earths) focused industry participant.



Source: Iluka Industry information pack Nov-2019

## KEY POINTS

The current corporate structure came about in 2012 when Astron redomiciled to Hong Kong and the ASX listed securities for the company changed to CDIs.

At the time Astron's key operations were all based in China.

A demerger of the processing (Yingkou) assets and entities was proposed in 2021 but did not proceed.



Source: Astron Company Presentation October 2022

## SUMMARY BALANCE SHEET

P&L \$m (June YE)	FY22	FY23	FY24	FY25	FY26	FY27	FY28	FY29	FY30
China Processing Plant	19	20	20	20	20	20	20	20	20
Donald Project	-	-	-	298	298	298	298	298	298
<b>Total Revenue</b>	<b>19</b>	<b>20</b>	<b>20</b>	<b>318</b>	<b>318</b>	<b>318</b>	<b>318</b>	<b>318</b>	<b>318</b>
Cost of Sales	(15)	(16)	(16)	(196)	(196)	(196)	(196)	(196)	(196)
<b>Gross Profit</b>	<b>4</b>	<b>4</b>	<b>4</b>	<b>122</b>	<b>122</b>	<b>122</b>	<b>122</b>	<b>122</b>	<b>122</b>
<b>EBITDA</b>	<b>(5)</b>	<b>(2)</b>	<b>(2)</b>	<b>116</b>	<b>116</b>	<b>116</b>	<b>116</b>	<b>116</b>	<b>116</b>
Depreciation and Amortisation	(2)	(2)	(2)	(11)	(20)	(19)	(18)	(18)	(17)
<b>EBIT</b>	<b>(7)</b>	<b>(4)</b>	<b>(4)</b>	<b>106</b>	<b>97</b>	<b>98</b>	<b>98</b>	<b>99</b>	<b>99</b>
Net Interest	(1)	(1)	(1)	(19)	(19)	(19)	(19)	(15)	(11)
<b>NPBT</b>	<b>(7)</b>	<b>(4)</b>	<b>(4)</b>	<b>86</b>	<b>78</b>	<b>78</b>	<b>79</b>	<b>84</b>	<b>88</b>
Income Tax (Expense)/Benefit	(2)	0	0	0	0	0	0	0	0
<b>NPAT</b>	<b>(9)</b>	<b>(4)</b>	<b>(4)</b>	<b>86</b>	<b>78</b>	<b>78</b>	<b>79</b>	<b>84</b>	<b>88</b>
EPS (cps)	(7)	(4)	(2)	31	24	24	24	26	27
DPS (cps)	0	0	0	15	12	12	12	13	14
Balance Sheet (A\$m) (June YE)	FY22	FY23	FY24	FY25	FY26	FY27	FY28	FY29	FY30
Cash & Equivalents	2	3	129	101	192	277	318	363	412
Receivables	14	14	14	14	14	14	14	14	14
Inventory	3	3	3	3	3	3	3	3	3
Other Current Assets	0	0	0	0	0	0	0	0	0
<b>Total Current Assets</b>	<b>19</b>	<b>19</b>	<b>145</b>	<b>117</b>	<b>208</b>	<b>293</b>	<b>334</b>	<b>379</b>	<b>428</b>
Receivables	0	0	0	0	0	0	0	0	0
PPE & Right-of-Use Assets	27	26	206	377	365	353	341	330	320
Exploration & Development	85	85	84	84	84	83	83	83	82
<b>Total Non-Current Assets</b>	<b>112</b>	<b>111</b>	<b>291</b>	<b>461</b>	<b>448</b>	<b>436</b>	<b>424</b>	<b>413</b>	<b>402</b>
<b>TOTAL ASSETS</b>	<b>13</b>	<b>13</b>	<b>44</b>	<b>58</b>	<b>66</b>	<b>73</b>	<b>76</b>	<b>79</b>	<b>83</b>
Trade & Other Payables	12	12	12	12	12	12	12	12	12
Borrowings	14	0	6	0	6	50	50	50	50
Other Current Liabilities	3	3	3	3	3	3	3	3	3
<b>Total Current Liabilities</b>	<b>33</b>	<b>20</b>	<b>26</b>	<b>20</b>	<b>26</b>	<b>70</b>	<b>70</b>	<b>70</b>	<b>70</b>
Borrowings	0	13	239	239	233	183	133	83	33
Other Non-Current Liabilities	12	12	12	12	12	12	12	12	12
<b>Total Non-Current Liabilities</b>	<b>12</b>	<b>24</b>	<b>251</b>	<b>251</b>	<b>244</b>	<b>194</b>	<b>144</b>	<b>94</b>	<b>44</b>
<b>TOTAL LIABILITIES</b>	<b>45</b>	<b>44</b>	<b>277</b>	<b>270</b>	<b>270</b>	<b>264</b>	<b>214</b>	<b>164</b>	<b>114</b>
<b>Net Assets</b>	<b>(32)</b>	<b>(31)</b>	<b>(233)</b>	<b>(212)</b>	<b>(204)</b>	<b>(191)</b>	<b>(138)</b>	<b>(85)</b>	<b>(31)</b>
Issued Capital	77	82	159	222	222	222	222	222	222
Reserves	18	18	18	18	18	18	18	18	18
Retained Earnings	(9)	(14)	(18)	68	146	225	304	388	477
<b>TOTAL EQUITY</b>	<b>86</b>	<b>87</b>	<b>160</b>	<b>309</b>	<b>387</b>	<b>465</b>	<b>545</b>	<b>629</b>	<b>717</b>

Source: PAC Partners Analysis

## KEY POINTS

Astron has a long history including its time as a significant and dominant processor of zircon in China up until 2008 when the business was sold for over \$200m.

Date	Event
01-Dec-22	<b>Resource Update: Resource within MIN5532 Phase 1 development area for Donald Project updated to include 525Mt @4% Heavy Mineral (only 4% inferred, 75% in measured category) using a 1% HM cut off grade. Resource now includes material in the micron range 20 to 250, previously 38-90 (the key addition being the 20-38 micron fine grained fraction). Compared to 2016 Resource total tonnes increased 66%, contained HM increased 25%, contained zircon increased 5%, contained rare earths increased 60% including the addition of xenotime.</b>
23-Nov-22	Astron signs updated MoU with Yarriambiack Shire Council who plays host to the Donald Project within its shire boundaries. The MOU focuses on maximising the local social and economic opportunities.
18-Nov-22	Share purchase plan raises \$891k via 13% participation from eligible security holders including placing \$150k SPP shortfall.
17-Oct-22	\$5.9m fundraising via \$4m placement and \$1m director loan conversion, and share purchase plan. Issue price 54c is ~10% disc to last close and 15-day VWAP. Launch of max \$3m SPP. Directors (other than MD) contribute \$1.415m in placement funds, plus Managing Director conversion of \$1m loan to equity on same terms. Placement done via ASX rules 7.1 and 7.1A, and required shareholder approvals at AGM in November. Blue Ocean acted as LM for placement (2% mgt fee, 3% selling fee, 600k 3yr broker options 17/10/25 exp strike 81c).
18-Aug-22	<b>Release Feasibility Study Update which reduces ore throughput and changes the plant processing design. Resulting CapEx cost in the order of ~A\$350m.</b>
02-May-22	Qtrly report suggests pilot plant recoveries 86% titania, 85.5% zircon (72% premium, 13.6% secondary), 91% rare earth minerals.
21-Mar-22	Issued 60k converts \$100/note \$6m total. \$5m 10% / \$1m 0%. Matures 17/3/24. Converts to 11,111,111 shares (\$0.54c, a 24% premium at the time to 60day VWAP). Collins St Capital. Secured mortgage against Donald asset.
17-Mar-22	1H: Rev \$10.4m (+12%) China trading operations resumed. Gross profit \$2.1m (v \$4.3m). Expenses up including more staff for Donald Project. \$1.7m impairment China ops.
04-Nov-21	Slightly misses deadlines for lodging annual report and quarterly report due to issues with demerger.
21-Oct-21	Plan to demerge shelved due to court injunction as a result of action bought by shareholder with 15k CDIs worth \$6k
10-Sep-21	Court injunction was granted in Hong Kong preventing the completion of the demerger.
19-Jul-21	Demerger approved at EGM, including by majority shareholder.
02-Jul-21	Proposes to demerge the company's China based downstream processing and trading operations to focus the listed company solely on the Donald Project. Demerger is to take place by giving ATR shareholders unlisted shares in the HK entity that holds the Chinese domiciled assets. Key drivers being the differing nature of the businesses, contrasting funding requirements, differing regulatory requirements (Australia v China) and other factors.
08-Apr-21	<b>Metallurgical Testwork Update. Premium Zircon Test Results Achieved: Testing of the Donald Mineral Sands product rated favourably in terms of whiteness (a highly desirable characteristic for main end-use market in ceramics). Premium product expected to constitute 80% (i.e. 95ktpa) of Stage 1 production with no acid leaching required to meet customer specifications. Stage 2 has potential to double Zr production. Premium Zr is defined as Zircon with a ZrO2 conc. higher than 66% - sought for use in ceramic applications, derives higher price to standard and chemical grade Zr products.</b>
30-Mar-21	<b>Metallurgical Testwork Update: Confirmed ability to produce high quality RE concentrate from froth flotation techniques, at recovery rate of 94.6% from HMC. Achieved high quality zircon final product, recoveries of Zr was up to 90.8% from HMC. Titaniu, recovery of up to 94.4% from HMC, potential upside to produce a 65% Ti concentrate.</b>
18-Feb-21	<b>Revised Ore Reserve Statement: 602Mt of ore with an average HM grade of 4.8%. Approximately 28.9Mt of heavy minerals, comprised of 5.4Mt zircon, 9.2Mt of illmenite, 8Mt of higher titanium content products (rutile and leucoxene). And 491kt of rare earths.</b>
17-Feb-21	<b>Mr Tiger Brown appointed Managing Director of Astron on \$100k/yr. No STI or LTIs but is major shareholder.</b>
15-May-20	Astron completes significant Wet Concentrator piloting works. 1,000t of run of mine (ROM) ore material from the Donald Project was treated in a purpose built 4 stage pilot gravity separation plant in Southern Queensland. The feed preparation was selective and aided the removal of oversize +3mm and slimes at -20µ sizes. Significant findings from the piloting works, including the recoverability of the finer WIM style minerals. The recoverability of the finer materials compares favourably against historical challenges with the finer grained resources. The VHM (Very / Valuable Heavy Mineral) recovery was tested at various heavy mineral concentrate (HMC) grades. Acceptable recoveries were maintained at both 85% and 95% HMC grade.
30-Nov-19	MD and founder of Astron, Mr Alex Brown passes away. Kang Rong appointed CEO. Tiger Brown, son of Alex and Kang, appointed executive director.
2019	Market for electric vehicles and renewal energy generation (in particular wind) accelerates, increasing demand for additional sources of rare earth minerals brining Donald project rare earth material closer to being economic (under the 2013 DFS this material was deemed not marketable / not included in the product suite).

## KEY POINTS

Astron was listed in 1983 focused elsewhere within the mineral sands industry, meanwhile the Donald deposit was discovered in 1985 by CRA and subsequently acquired by Astron in 2004.

Date	Event
<b>03-Jul-18</b>	<b>Donald project EPC contract lapses as result of conditions precedent unable to be satisfied.</b>
27-Apr-18	Astron's China based mineral sands processing unit signs construction contract to build 150kt/yr processing plant to produce artificial rutile for use as a high quality feedstock for chlorination methods with TiO <sub>2</sub> powder production plants in China, an alternative to the sulphuric acid production process. Initially Astron will use suitable available lower grade TiO <sub>2</sub> feedstocks although intends ultimately to use its own main TiO <sub>2</sub> feedstock from its Donald project.
2018	1000t of ore processed through pilot plant, confirming commercial recoveries.
07-Dec-17	Agrees another extension with CMEC until 30-June-18
01-May-17	Agrees with CMEC to extend time to satisfy EPC and funding agreement until 1-Dec-2017
<b>2015-2016</b>	<b>Zircon Market stabilised following a period of volatility, entering into steady demand growth and limited new supply.</b>
07-Apr-16	Astron reports updated Mineral Resource for Donald Project
04-Oct-16	Astron and CMEC agreed to extend the time for satisfying the relevant conditions until May 1, 2017. ATR to secure funds and awaiting for government approvals.
<b>01-Oct-15</b>	<b>Signs US\$95m EPC &amp; Project Funding contract with CMEC of China. Project funding to come from Chinese banks. 15% of funding to come from Astron.</b>
2014	In China, Astron commences construction of high purity zirconia production facility, China (completed 2017)
<b>11-Apr-14</b>	<b>Signs an engineering, procurement and construction (EPC) framework agreement with China Machinery Engineering Corporation (CMEC).</b>
<b>31-Jul-13</b>	<b>Donald DFS released (NPV US\$1.7bn, 31 year mine life, Phase One 475kt/yr HMC. Phase 2 plan to double scale, capex A\$518m, 2.75% royalty, 2 products only 60:40 zircon:titanium).</b>
2012	Water rights secured for Donald Project. Taylor Lake Reservoir 20km away.
June-2012	JORC statement issued for Donald Project 461Mt at 5.9% HM and 19% Zr 7.5% Rutile 33.6% Ilmenite
11-Feb-20	POSCO signs non-binding MoU to become funding partner of Donald Project and its downstream processing facilities. POSCO keen on zirconium tubes, used to manufacture fuel rods for nuclear power stations.
2010	Stage 1 Mining Licence issued for Donald Project
2009	Donald Project Environmental Effects Statement approved
2008	Sale to Imerys closes, Astron's retains China zircon trading business in Shenyang and related R&D in Yingkou.
29-Aug-07	French mineral processing group Imerys buys Astron China for EUR 121m (US\$165m / A\$220m). FY07 Astron China recorded revenue RMB 1.2bn / US\$160m. Deal to close in 2008.
<b>2006-2010</b>	<b>Iluka's development of Jacinth-Ambrosia project (1,500km west of Donald) satisfied global zircon demand, pushes down prices ultimately leading to delay in development of Astron's Donald Project.</b>
2004	Astron buys Donald Project for A\$11m from Zirtanium Pty Ltd.
1992	Shenyang Astron Mining Industries established / Import of zircon sand into China, export of zircon chemicals
1988	Astron becomes involved in 2 zirconium projects in China.
1983	Astron lists on ASX - Establishes zircon sales, marketing, chemical product processing in China
1985	CRA (precursor company to Rio Tinto) discovers Donald Deposit.



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## RECOMMENDATION CRITERIA

### Investment View

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