Zacks Small-Cap Research

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Arrowhead Research (ARWR-NASDAQ)

ARWR: Strong balance sheet, ARC-520 is still alive**,** on track initiate Phase IIb of ARC-520, ARC-AAT to start Phase I soon – maintaining Outperform

Current Recommendation	**Outperform**
Prior Recommendation	N/A
Date of Last Change	06/11/2013
Current Price (11/25/14)	$5.84
Twelve- Month Target Price	**$15.00**

OUTLOOK

ARWR is a clinical stage biotech company focused on RNAi targeted therapy using DPC platform technology. We are optimistic about the Company's lead program ARC-520 for HBV.

ARWR just released initial Phase IIa data, which were as strong as expected, but the program is still viable in our view. The Company plans to initiate Phase IIb of ARC-520 in 4Q14. The Company just announced its second clinical candidate ARC-AAT for liver disease and will start a Phase I soon.

Balance sheet is strong.

We maintain our Outperform rating on its shares.

SUMMARY DATA

52-Week High	**$26.57**
52-Week Low	**$5.55**
One-Year Return (%)	**-21.29**
Beta	**2.63**
Average Daily Volume (sh)	**2,426,154**
Shares Outstanding (mil)	**53**
Market Capitalization ($mil)	**$309**
Short Interest Ratio (days)	**1.81**
Institutional Ownership (%)	**59**
Insider Ownership (%)	**2**
Annual Cash Dividend	**$0.00**
Dividend Yield (%)	**0.00**
5-Yr. Historical Growth Rates	
Sales (%)	**N/A**
Earnings Per Share (%)	**N/A**
Dividend (%)	**N/A**
P/E using TTM EPS	**N/A**
P/E using 2013 Estimate	**N/A**
P/E using 2014 Estimate	**N/A**
Zacks Rank	**N/A**

Risk Level	**High,**
Type of Stock	**Small-Growth**
Industry	**Biotechnology**
Zacks Rank in Industry	**N/A**

ZACKS ESTIMATES

Revenue
(in millions of $)

	Q1 (Dec)	Q2 (Mar)	Q3 (Jun)	Q4 (Sep)	Year (Sep)
2013	0.16 A	0.04 A	0.04 A	0.04 A	0.29 A
2014	0.04 A	0.04 A	0.04 A	0.04 A	0.18 A
2015	0.04 E	0.04 E	0.04 E	0.04 E	0.16 E
2016					0.30 E

Earnings per Share
(EPS is operating earnings before non recurring items)

	Q1 (Dec)	Q2 (Mar)	Q3 (Jun)	Q4 (Sep)	Year (Sep)
2013	-$0.33 A	-$0.41 A	-$0.18 A	-$0.35 A	-$1.24 A
2014	-$0.19 A	-$0.25 A	-$0.24 A	-$0.43 E	-$1.15 A
2015	-$0.26 E	-$0.29 E	-$0.30 E	-$0.33 E	-$1.18 E
2016					-$1.30 E

Zacks Projected EPS Growth Rate - Next 5 Years % **N/A**

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WHAT'S NEW

- **Fiscal 2014 financials reported, balance sheet remained strong;**
- **Interim Phase IIa ARC-520 data presented, full data expected in 1H15;**
- **Reiterate Outperform rating and maintain PT of $15;**
- **On track to initiate ARC-520 Phase IIb study at the end of 2014;**
- **IND has been filed for second candidate ARC-AAT, Phase I trial to start soon;**

Arrowhead Exited Fiscal 2014 with a Strong Balance Sheet

On November 25, Arrowhead (ARWR) reported financial results for fiscal 2014 ended September 30, 2014.

There was no meaningful revenue for fiscal 2014.

R&D expenses were $23.1 million for fiscal 2014, compared to $8.7 million for fiscal 2013.

SG&A expenses were $18.7 million for fiscal 2014, compared to $10.2 million for fiscal 2013.

Total operating expenses for fiscal 2014 were $48.7 million, compared to $24.6 million for fiscal 2013.

Net loss for fiscal 2014 was $58.7 million ($1.25 per share), compared to a net loss of $31.1 million ($1.30 per share) for fiscal 2013.

The Company's balance sheet remained strong. As of September 30, 2014, the Company's cash and investments of cash were $177.3 million.

In February, 2014, Arrowhead closed an underwritten offering of 6,325,000 shares of common stock. The offering was priced at $18.95 per share and the Company received gross proceeds of approximately $120 million.

The Company's current cash should be able to fund the planned Phase IIb and Phase III trial. The strengthened balance sheet will allow the Company to accelerate the development of its pipeline.

Efficacy of ARC-520 Phase IIa not as Strong as Expected, But the Program Is still Viable

On November 10, Arrowhead presented interim data on ARC-520 in a late-breaking poster titled **"*Phase II, dose ranging study of ARC-520, a siRNA-based therapeutic, in patients with chronic hepatitis B virus infection*"** at the 2014 American Association for the Study of Liver Diseases (AASLD) Liver Meeting being held on November 7-11, 2014, in Boston.

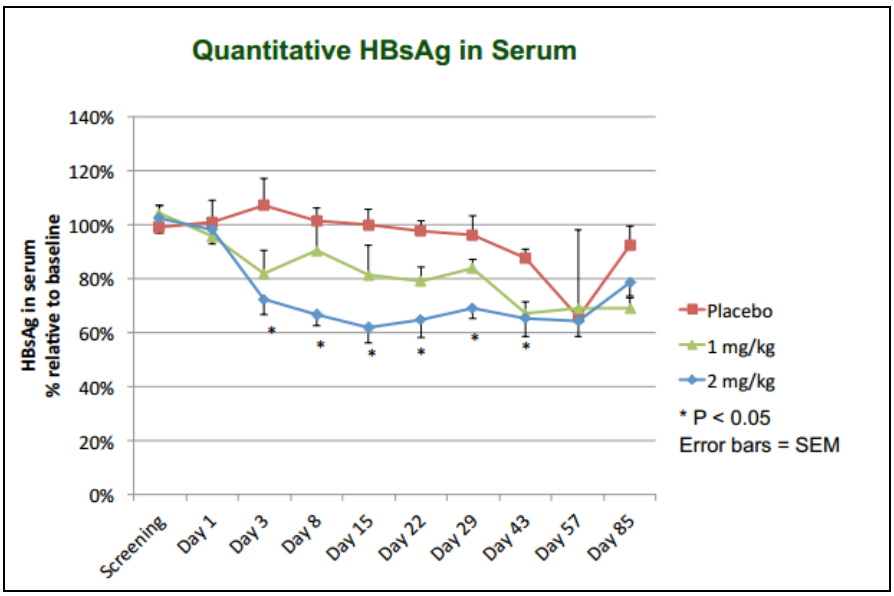
The ongoing Phase IIa is a randomized, double blind, placebo controlled study, which will enroll up to 24 chronic HBV patients in **three dose cohorts** with patients receiving either ARC-520 or placebo **in combination with entecavir**. Patients are randomized to placebo or ARC-520 at a ratio of 1:3 and continue daily entecavir. **Primary endpoints** will be safety and tolerability as well as depth and duration of surface antigen knock down. Patients will be followed until surface antigen levels return to baseline.

The Phase IIa trial began doing patients on March 24, 2014 in Hong Kong. The Phase IIa study has enrolled three dose cohorts including 24 patients, 18 receiving drug and 6 receiving placebo. Unblinded data are available for the first two cohorts. Cohort 3 data collection is ongoing and this cohort remains blinded. Full results for the first two dose cohorts at 1.0 mg/kg and 2.0 mg/kg and partial (blinded) safety results from the 3.0 mg/kg dose cohort were included in the poster.

Per the poster, ARC-520 was **safe and well tolerated** in all three cohorts. There were no SAEs, no signs of hypersensitivity, no dose limiting toxicities and no discontinuations due to AEs. There were no treatment emergent changes in vital signs, physical exams or ECGs rated clinically significant by the investigator. There have been few abnormal laboratory values, with no clinically significant, treatment emergent, changes in ALT, AST, GGT, LDH, bilirubin, BUN or creatinine or apparent trends. All AEs reported to date (n=6) have been mild or moderate and rated as unrelated to study drug by the investigator.

Adverse Event	Placebo n=4	Cohort 1 n=6	Cohort 2 n=6	Cohort 3 n=8 (blinded)
All	0	1	4	1
Flu like symptoms		1 mild		
CK elevation			1 mild	
Injection extravasation			1 mild	
Near syncope			1 mod	
Malaise			1 mod	
Leg pain				1 mild

Efficacy of ARC-520 was measured as HBsAg decline from baseline. In the 1 mg/kg cohort, mean nadir HBsAg was -39% (range -22 to -57) with a mean change on day 85 of -31% (range -14 to -39). In the 2 mg/kg cohort, mean nadir HBsAg was – **51%** (range -46 to -59) with a mean change on day 85 of -22% (range -7 to -40). For 2 mg/kg cohort, the HBsAg reduction was statistically significant vs placebo for Days 3 through 43 post dose. For cohort 2, the mean day of HBsAg nadir was day 33 with a range of day 8 to day 57.



This Phase IIa study is ongoing with follow up continuing on Cohort 3 (3.0 mg/kg) and recruitment underway for a fourth cohort of patients at 4.0 mg/kg. Full data from the Phase IIa will be available in **1H15**.

Our Takeaways from the Preliminary Phase IIa Data

Following the release of the initial Phase IIa data, share price of Arrowhead declined more than 50%. We think this is an **overreaction**.

First, we think that in general the preliminary data are positive. ARC-520 demonstrated a strong safety profile and a modest efficacy for chronic HBV patients in the Phase IIa study. Remember, this is the first time that an HBsAg reduction is mediated through RNAi in chronic HBV patients.

Second, we have seen the dose dependent reduction of HBsAg in the Phase IIa study with a 39% reduction in the 1 mg/kg dose and 51% reduction in the 2 mg/kg dose. We expect further HBsAg reduction in the 3 mg/kg dose when the data are unblinded later this year.

Thirdly, an increase of dose to 4 mg/kg could further reduce HBsAg in HBV patients.

Further, the multi-dose, multi-national Phase IIb trial will proceed as planned.

With the positive data, why the market overreacted to the positive data negatively? We think there is a misunderstanding the market has about the anticipated data.

Misunderstanding number 1: the market has been anticipating a much deeper knockdown of HBsAg (about 1 log, 90%). Management did say in recent conference calls, that their goal is to **identify a dose** of ARC-520 capable of achieving HBsAg reduction of around 1 log after a single administration.

On the surface of it, the 51% reduction (about 0.3 log) at the 2 mg/kg dose is far from the 1 log (90% reduction) goal. But we remind investors that the Company is still waiting for data from the 3 mg/kg dose. Since ARC-520 has demonstrated excellent safety profile in healthy humans at 4 mg/kg dose, a dose increase to 4 mg/kg is possible if ARC-520 is safe and tolerated at the 3 mg/kg dose.

Further, our understanding is that the goal of 1 log reduction is based on scientific literature. A small number of patients who achieve functional cure from Interferon therapy demonstrate ½ log reduction in HBsAg (70% knockdown) after 12 weeks and 1 log (90% knockdown) after 24 weeks. If ARC-520 can lead to more rapid reduction, particularly on repeat dosing, a 1 log reduction may not be needed after a single administration. A 0.5 log to 0.8 log (70% to 85%) reduction in HBsAg may still work for ARC-520 after single administration.

Misunderstanding number 2: The Phase IIa data are weak than data from animal model.

In the chimpanzee study, ARC-520 achieved 80-85 reduction in HBsAg at the dose of 3 mg/kg. At 2 mg/kg dose, ARC-520 achieved 50% reduction in HBsAg, which was similar to the reduction in the Phase IIa trial. With the data from 3 mg/kg coming in, we may see similar knockdown of HBsAg in humans compared to that in chimpanzee.

Our Conclusion

We think the initial data from the ongoing Phase IIa trial were not that bad and market overreacted to the generally positive data.

Arrowhead just completed the first two dose cohorts in the Phase IIa dosing finding study, and has not yet identified a dose in humans that will meet the HBsAg knockdown goal.

Arrowhead just finished dosing all 8 patients in the 3 mg/kg cohort. The Company is screening patients for the 4 mg/kg does. Even with the dose increase to 4 mg/kg, the **Phase IIb** will proceed as planned.

That said, we do see increased uncertainty in this program due to the not that strong data from the first 2 cohorts. The increase of the dose may increase safety risks and impact the timeline of this program. Also the increase of dose may not guarantee an increased efficacy.

With all these in mind, we think the ARC-520 program is still viable, but with increased risks. Therefore we reiterate our **Outperform** rating on Arrowhead shares but lower our **price target to $15** per share reflecting the increased risks.

Our price target is based on a 35x P/E ratio, multiplied by an EPS of $1.09 at the end of 2019, discounted at 25% for 4 years.

Phase IIb Will Be Initiated in 4Q14 as Planned

As discussed above, Arrowhead does not expect timing of the program to be impacted and will submit regulatory filings **by the end of the year** in support of the multi-dose Phase IIb study.

The **Phase IIb** will be a multi-dose, multi-national, and will likely include sites in the US, Europe and Asia. The Phase IIb study is designed to provide a read out on ARC-520's ability to achieve functional cure, among other outcome measures. Several studies are currently contemplated, including ARC-520 in combination with entecavir or tenofovir as well as combination studies that add an immunostimulatory agent.

We estimate top line results from the Phase IIb trial will be available in **mid-2015**. We expect Arrowhead will be able to initiate **pivotal Phase III** trial of ARC-520 in late 2015 or early 2016, and data should be available in late 2016. NDA could be filed in 1H2017, and the FDA approval is in late 2017 or early 2018.

We think ARC-520 is the primary value driver in near- and mid-term for Arrowhead. The successful development of ARC-520 is critical to Arrowhead because the HBV market offers opportunities for substantial revenues, and because validation of the Company's RNAi delivery technology opens broad opportunities both for other therapeutic programs and licensing opportunities.

In this regard, the completion of the Phase IIa study and the initiation of the Phase IIb of ARC-520 represent an important milestone for Arrowhead in achieving its long term growth goal. One of the attractive features of RNAi and of DPCs specifically is once the safety profile in man for the delivery system has been established; additional targets and candidates can be studied rapidly. Therefore the Phase II trials of ARC-520 will provide the company with the data needed to accelerate the development of its pipeline and bring additional candidates into the clinic.

Preclinical Data on ARC-AAT Presented

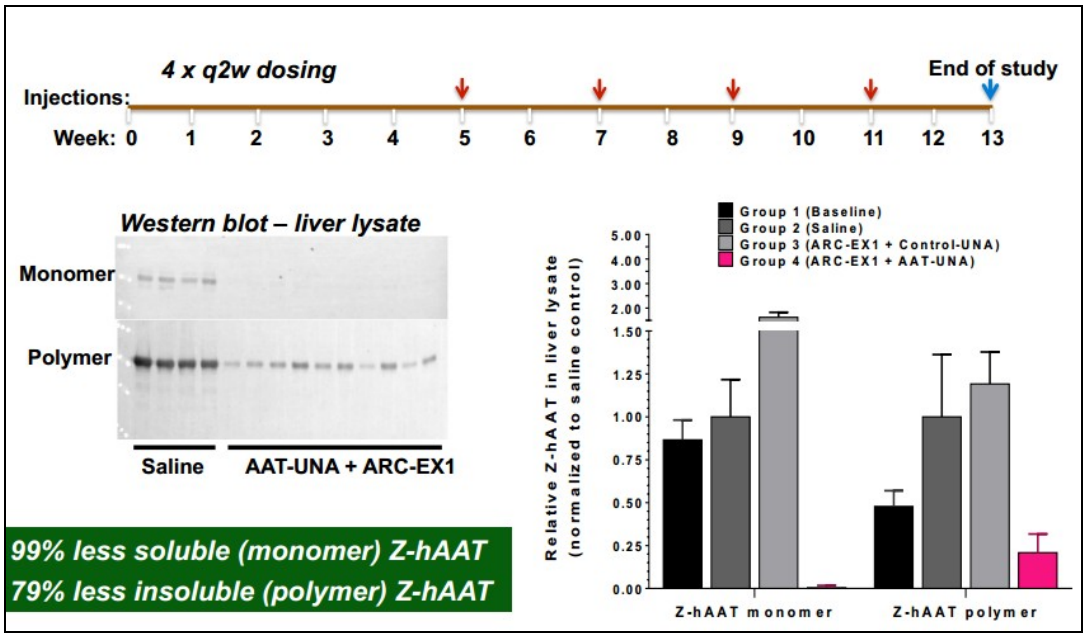
Arrowhead also presented preclinical data on ARC-AAT at the 2014 American Association for the Study of Liver Diseases (AASLD) Liver Meeting in November, 2015.

ARC-AAT is the Company's second clinical candidate indicated for the treatment of Alpha-1 antitrypsin deficiency (**AATD**)-associated **liver disease.**

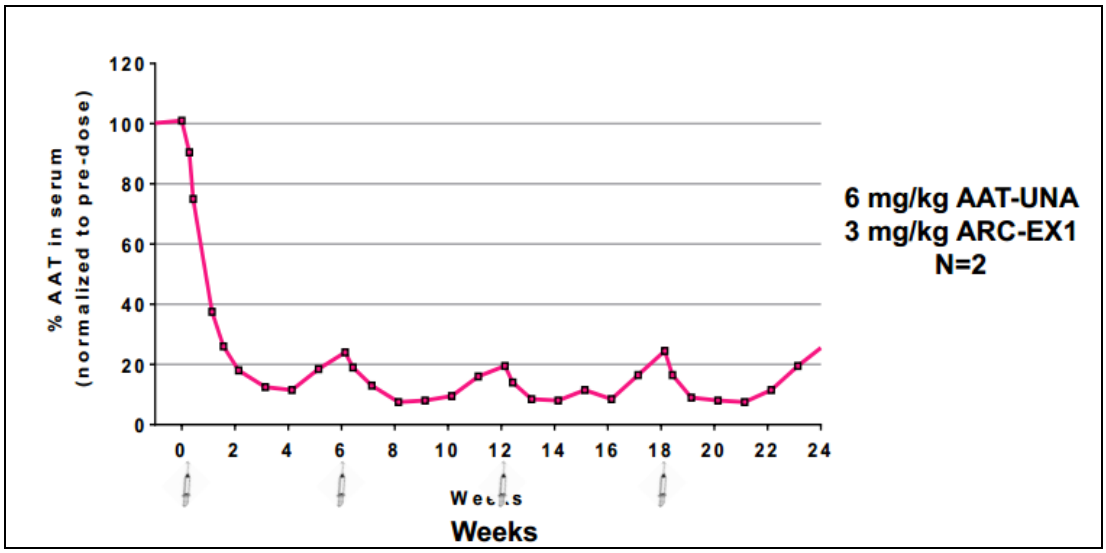
AATD is an autosomal recessive genetic disorder associated with liver disease in children and adults and pulmonary disease in adults. Alpha-1 antitrypsin is a **protease inhibitor** of a circulating glycoprotein of the serpin family encoded by the AAT gene and primarily synthesized in the liver. The physiologic function of AAT is inhibition of neutrophil proteases to protect healthy tissues during inflammation and prevent tissue damage. This is especially important **in the lung**.

The Z mutant is the most common disease variant and has a single amino acid substitution that results in improper protein folding causing severe impairment of secretion from hepatocytes. This lack of secretion leads to **accumulation** of mutant **Z-AAT** polymers, which form globules in the hepatocyte endoplasmic reticulum. This triggers continuous hepatocyte injury, leading to fibrosis, cirrhosis, and increased risk of hepatocellular carcinoma.

In **preclinical studies with PiZ mice**, which are genetically modified to produce the mutant human AAT (Z-AAT), ARC-AAT induced a greater than 95 percent reduction in circulating AAT after a single dose with a long duration of effect. Area covered by Z-AAT globules and globule size within the liver were significantly reduced after a single dose of ARC-AAT at day 15 post-dose ($p < 0.005$) and day 29 post-dose ($p < 0.01$). Multi-dose studies in PiZ mice showed that ARC-AAT was effective at reducing and preventing Z-AAT aggregates in the liver. At week 13 of the study, after 4 biweekly doses, the ARC-AAT treated group show 99% less soluble (monomer) Z-AAT and 79% less insoluble (polymer) Z-AAT, normalized to a saline control group. Thus, injection of ARC-AAT in transgenic mice expressing human Z-AAT resulted in prevention and reduction of Z-AAT globules and, importantly, liver inflammation.



In primate studies, a 90% reduction of AAT in serum was observed after a single injection, which persisted for over ten weeks with greater than 80 percent knockdown observed at the six-week time point. Multi-dose studies in primates showed a sustained reduction of AAT with once every six weeks dosing, suggesting that once monthly or less frequent dosing may be sufficient to maintain approximately 80-90% knockdown in humans. The treated animals showed no changes in clinical chemistry (ALT, AST, BUN, Creatinine), indicating that ARC-AAT appeared to be well tolerated at these optimal therapeutic dose levels.



AATD is considered to be a relatively **high prevalence orphan disease**, and it is frequently misdiagnosed or undiagnosed. European prevalence is estimated to be 1 per 2500.

PiZZ individuals have severe deficiency of functional AAT leading to pulmonary disease and hepatocyte injury and liver disease. **Lung disease** is frequently treated with AAT **augmentation therapy**. However, augmentation therapy does nothing to treat liver disease, and there is no specific therapy for hepatic manifestations. There is a significant unmet need as **liver transplant** is currently the only available cure.

Phase I Clinical Trial of ARC-AAT to Start Soon

Based on the preclinical results, in mid-November, Arrowhead filed an IND application for approval to begin a **Phase I** clinical trial of ARC-AAT for the treatment of liver disease associated with alpha-1 antitrypsin deficiency.

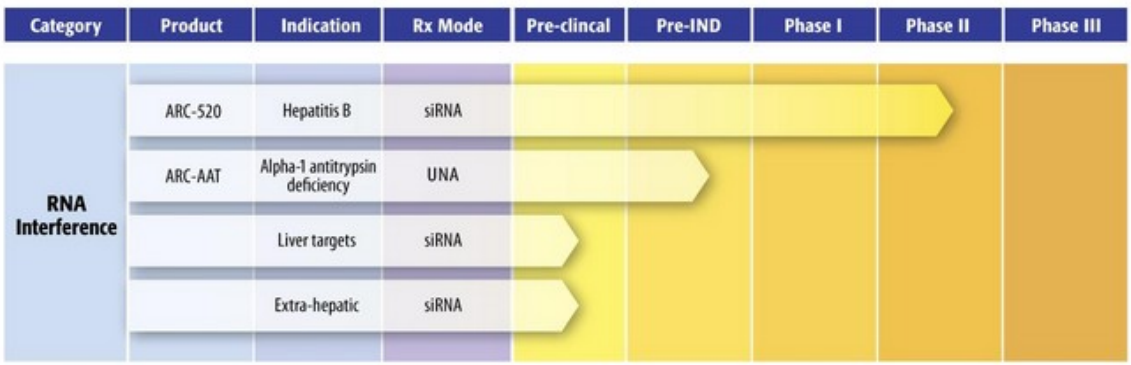
The planned Phase I trial will be a double blind, placebo-controlled dose escalation study to determine the safety, tolerability, pharmacokinetics and effect on circulating alpha-1 antitrypsin levels of ARC-AAT in healthy volunteers and patients with alpha-1 antitrypsin deficiency. The study is planned to start in **Australia** in healthy volunteers and will dose escalate until predetermined levels of alpha-1 antitrypsin reduction are reached. Once these levels of protein knockdown are achieved, the study will transition into a population of patients with ZZ genotype alpha-1 antitrypsin deficiency to further evaluate escalating doses of ARC-AAT. The study is designed to enroll up to **48 subjects**, including healthy volunteers and alpha-1 antitrypsin deficiency patients.

According to management, initial testing will be in **adult patients** with signs of liver injury, with the intention of preventing additional injury and improving liver histology. In the future, additional studies may be initiated to investigate treatment of children, including those with severe hepatic disease who may otherwise require liver transplant.

Arrowhead has signed an agreement with the Alpha-1 Project (TAP), a subsidiary of the **Alpha-1 Foundation**. Under the terms of the agreement, TAP will partially fund the development of ARC-AAT. In addition to the funding, TAP will make its scientific advisors available to Arrowhead, assist with patient recruitment for clinical trials thanks to the Alpha-1 Foundation Patient Research Registry, and engage in other collaborative efforts that support the development of ARC-AAT.

We are pleased to see that Arrowhead is diversifying its pipeline by nominating a second clinical candidate, which further de-risk its pipeline. In the absence of specific therapy other than liver transplant for AATD associated liver disease, we believe RNAi holds great potential.

With the experience of two candidates ARC-520 and ARC-AAT, the DPC platform, as well as a strong balance sheet, we believe Arrowhead is well positioned to further diversify its pipeline down the road.



PROJECTED INCOME STATEMENT

_	2014 (Sept)					2015 (Sept)					2016 (Sept)	2017 (Sept)	2018 (Sept)	2019 (Sept)
$ in millions except per share data	Q1	Q2	Q3	Q4	FY	Q1	Q2	Q3	Q4	FYE	FYE	FYE	FYE	FYE
Revenue	$0.04	$0.04	$0.04	$0.04	$0.18	$0.04	$0.04	$0.04	$0.04	$0.16	$0.30	$10.00	$125.00	$250.00
YOY Growth											-	*3233.3%*	*1150.0%*	*100.0%*
Total Revenues	**$0.04**	**$0.04**	**$0.04**	**$0.04**	**$0.18**	**$0.04**	**$0.04**	**$0.04**	**$0.04**	**$0.16**	**$0.30**	**$10.00**	**$125.00**	**$250.00**
YOY Growth	*-73.0%*	*0.0%*	*0.0%*	*1.7%*	*-39.7%*	*-7.0%*	*-8.6%*	*-8.6%*	*-10.1%*	*-8.6%*	*87.5%*	*3233.3%*	*1150.0%*	*100.0%*
Cost of Revenue	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$1.5	$18.8	$35.0
Gross Income	**$0.0**	**$0.0**	**$0.0**	**$0.0**	**$0.2**	**$0.0**	**$0.0**	**$0.0**	**$0.0**	**$0.2**	**$0.3**	**$8.5**	**$106.3**	**$215.0**
Gross Margin	*100.0%*	*100.0%*	*100.0%*	*100.0%*	*100.0%*	*100.0%*	*100.0%*	*100.0%*	*100.0%*	*100.0%*	*100.0%*	*85.0%*	*85.0%*	*86.0%*
R&D	$3.1	$5.2	$6.4	$8.4	$23.1	$8.5	$9.0	$9.5	$10.0	$37.0	$45.0	$50.0	$55.0	$60.0
% R&D	*7286.1%*	*11923.3%*	*14610.7%*	*18868.3%*	*13221.7%*	*21250.0%*	*22500.0%*	*23750.0%*	*25000.0%*	*23125.0%*	*15000.0%*	*500.0%*	*44.0%*	*24.0%*
SG&A	$3.0	$4.4	$4.0	$7.2	$18.7	$5.0	$5.5	$6.0	$6.5	$23.0	$25.5	$30.0	$37.5	$50.0
% SG&A	*6966.5%*	*10161.3%*	*9227.2%*	*16281.6%*	*10699.1%*	*12500.0%*	*13750.0%*	*15000.0%*	*16250.0%*	*14375.0%*	*8500.0%*	*300.0%*	*30.0%*	*20.0%*
Other expenses	$0.9	$1.6	$2.3	$2.2	$7.0	$1.0	$1.5	$1.5	$2.0	$6.0	$7.0	$8.5	$10.0	$12.0
% Other	*2150.1%*	*3643.9%*	*5290.8%*	*4962.5%*	*4023.9%*	*2500.0%*	*3750.0%*	*3750.0%*	*5000.0%*	*3750.0%*	*2333.3%*	*85.0%*	*8.0%*	*4.8%*
Operating Income	**($7.0)**	**($11.2)**	**($12.7)**	**($17.8)**	**($48.7)**	**($14.5)**	**($16.0)**	**($17.0)**	**($18.5)**	**($65.8)**	**($77.2)**	**($80.0)**	**$3.8**	**$93.0**
Operating Margin	-	-	-	-	-	-	-	-	-	-	-	-	-	*37.2%*
Other Income (Net)	($3.6)	($2.7)	$1.1	$0.7	($4.5)	$0.0	$0.0	$0.0	$0.0	$0.0	($0.5)	($0.5)	($0.5)	($0.5)
Pre-Tax Income	**($10.6)**	**($13.9)**	**($11.6)**	**($17.1)**	**($53.3)**	**($14.5)**	**($16.0)**	**($17.0)**	**($18.5)**	**($65.8)**	**($77.7)**	**($80.5)**	**$3.3**	**$92.5**
Net Taxes (benefit)	$0.0	$0.0	$0.0	$5.4	$5.4	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
Tax Rate	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*-10.2%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*
Reported Net Income	**($10.6)**	**($13.9)**	**($11.6)**	**($22.5)**	**($58.7)**	**($14.5)**	**($16.0)**	**($17.0)**	**($18.5)**	**($65.8)**	**($77.7)**	**($80.5)**	**$3.3**	**$92.5**
YOY Growth	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Net Margin	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Weighted avg. Shares Out	*37.7*	*44.3*	*51.9*	*53.7*	*46.9*	*55.0*	*55.0*	*56.0*	*56.5*	*55.6*	*60.0*	*70.0*	*80.0*	*85.0*
Reported EPS	**($0.28)**	**($0.31)**	**($0.22)**	**($0.42)**	**($1.25)**	**($0.26)**	**($0.29)**	**($0.30)**	**($0.33)**	**($1.18)**	**($1.30)**	**($1.15)**	**$0.04**	**$1.09**
YOY Growth	-	-	-	-	-	-	-	-	-	-	-	-	-	-
One time charge	$3.62	$2.73	($1.07)	($0.73)	$4.55	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Non GAAP Net Income	**($7.0)**	**($11.2)**	**($12.7)**	**($23.3)**	**($54.2)**	**($14.5)**	**($16.0)**	**($17.0)**	**($18.5)**	**($65.8)**	**($77.7)**	**($80.5)**	**$3.3**	**$92.5**
Non GAAP EPS	**($0.19)**	**($0.25)**	**($0.24)**	**($0.43)**	**($1.15)**	**($0.26)**	**($0.29)**	**($0.30)**	**($0.33)**	**($1.18)**	**($1.30)**	**($1.15)**	**$0.04**	**$1.09**

Source: Company filing and Zacks Investment Research estimates

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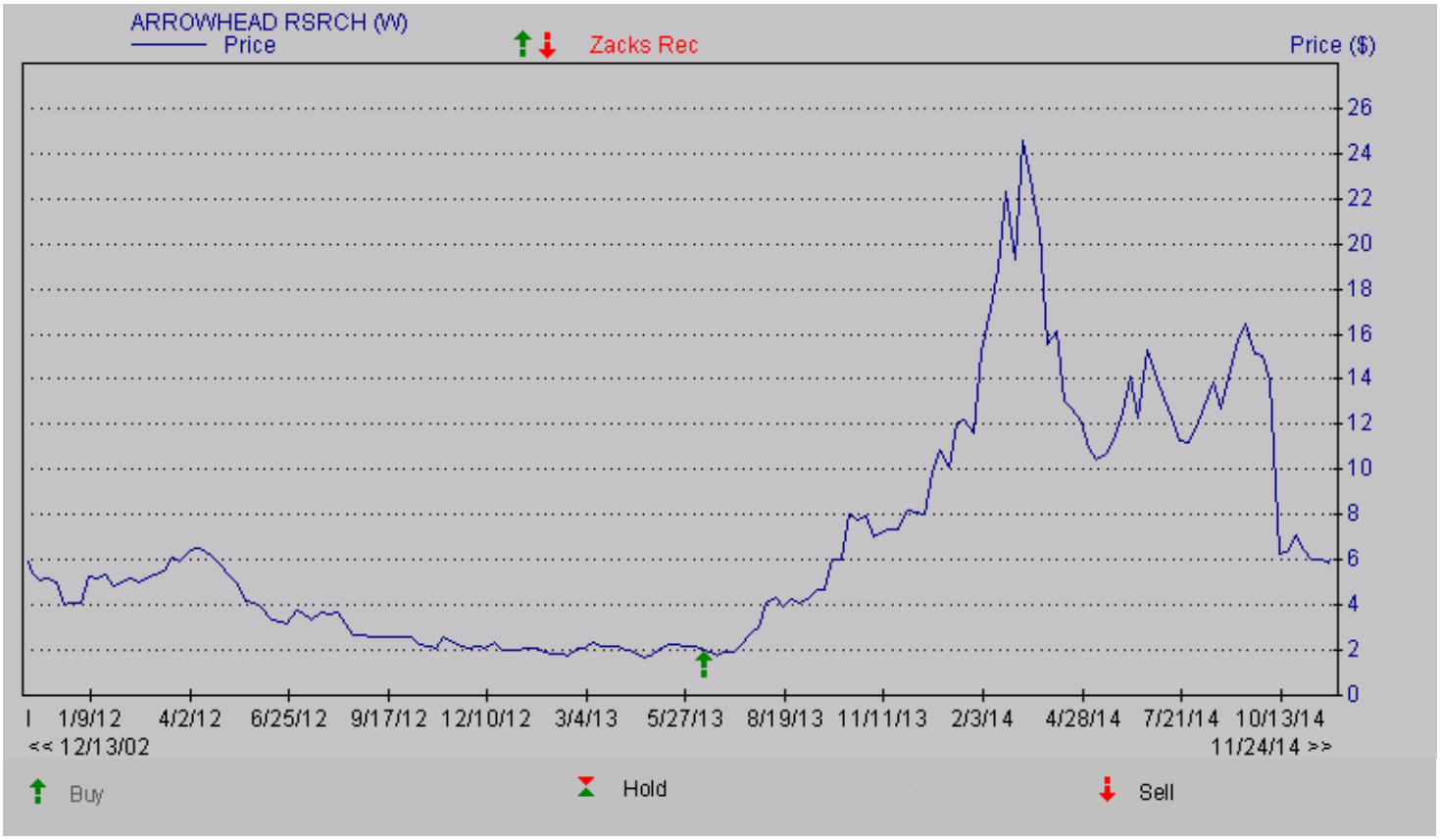
HISTORICAL ZACKS RECOMMENDATIONS



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