



RD Instruments
Acoustic Doppler Solutions

StreamPro ADCP Application Note: StreamPro ADCP Discharge Measurements in an Irrigation Canal (Imperial Irrigation District, California)

SUMMARY: Discharge measurement tests using RD Instruments new StreamPro ADCP were conducted in an irrigation canal at Imperial Irrigation District, California on August 27, 2003. A total of 17 transects of discharge measurements were made. The Coefficient of Variation (CV) and Maximum Deviation from Mean (MDM), which measure the uncertainty of the discharge measurements, are 1.9% and 3.5% respectively. Both of the CV and MDM meet the USGS standards for discharge measurement quality assurance (QA): CV < 5% and MDM < 5%. The results indicated that StreamPro provided repeatable and accurate discharge measurements.

The irrigation canal at the test site was 40 ft wide and its maximum depth was 4.2 ft. The mean velocity was 1.2 ft/s. The flow was steady during the test period. Figure 1 shows the test site. A pulley system was employed to pull the StreamPro across the canal. The use of a pulley system made it easy to maintain a slow and constant speed of the float.



Figure 1: StreamPro attached to a pulley system at the test site.

The StreamPro quickly and easily configured using its software running on iPAQ pocket PC. The site conditions allowed the use of the default settings for StreamPro.

The parameter default settings are summarized as follows:

- Transducer depth: 5 cm
- Cell size: 10 cm
- Number of cells: 20 cm

A total of 17 transects were made from 10:00 am to 3:00 pm. The float speed was kept at approximately 0.3 ft/s. Each transaction took about 2-3 minutes to complete.

Figure 2 shows a screenshot from WinRiver software playing back a StreamPro data file collected from a transect. The top plot shows the velocity magnitude contour as well as water depth along the float track. Since the float was attached to the pulley system, its track was nearly a straight line during a transect. Therefore, this plot also shows the approximate geometry of the canal cross-section.

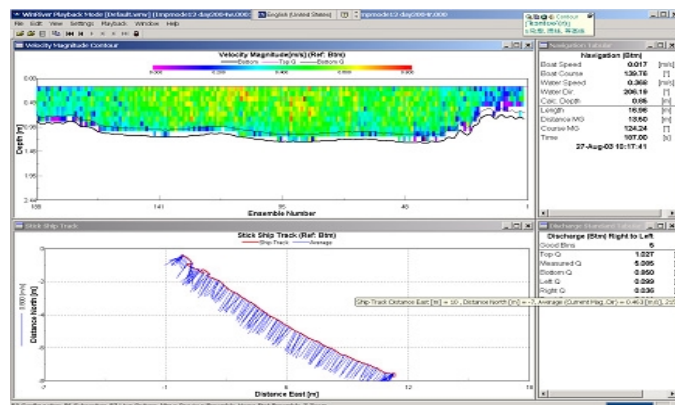


Figure 2: Screenshot from WinRiver software when playing

The bottom plot on the screenshot shows the float track (red line) as well as depth-averaged velocity vector (blue sticks) along the track.

The StreamPro outputs the velocity vectors (and all other data) at 1 Hz, i.e., one vector per second (StreamPro pings at a fixed rate of 40Hz). It should be noted that the velocity direction and float track direction are relative to the ADCP instrument coordinates, not to earth coordinates. This is because StreamPro has no compass installed in it. A compass is not needed for discharge measurement when float (or boat) velocities are obtained from bottom tracking data.

Table 1 and Figure 3 show discharge data from 17 transects. Some statistics of the discharge data set are obtained as follows:

- Mean = 253.0 cfs
- Standard deviation = 4.8 cfs
- Coefficient of Variation, CV = mean/standard deviation = 1.9%
- Maximum Deviation from Mean, MDM = max (individual discharge – mean)/mean = 3.5%

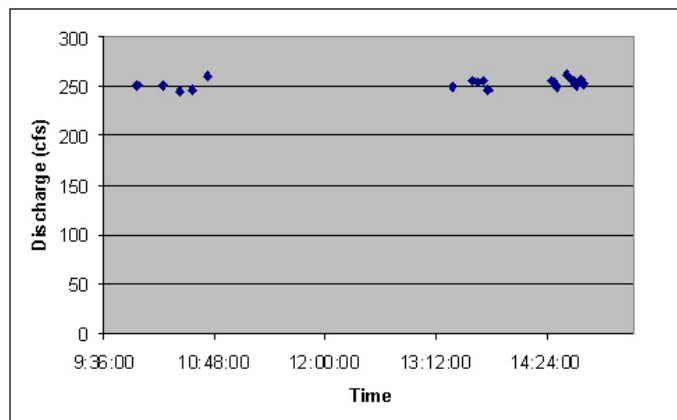


Figure 3: Imperial Irrigation canal discharge on August 27, 2003. Data are from 17 StreamPro measurements shown in Table 1 below.

Table 1 Summary of StreamPro ADCP Discharge Measurements

Transect	Start Time	End Time	Discharge (cfs)
1	09:57:45	10:00:50	251.5
2	10:14:34	10:17:41	250.7
3	10:25:31	10:28:56	245.7
4	10:33:20	10:36:56	246.3
5	10:42:54	10:46:57	260.3
6	13:23:05	13:26:40	249.3
7	13:35:33	13:39:11	256.7
8	13:39:33	13:42:32	253.8
9	13:42:43	13:45:34	254.8
10	13:45:59	13:48:39	246.6
11	14:27:44	14:30:24	254.7
12	14:30:32	14:32:54	249.2
13	14:37:27	14:40:17	261.9
14	14:40:33	14:43:08	257.4
15	14:43:26	14:45:58	251.7
16	14:46:12	14:48:11	257.5
17	14:48:23	14:52:33	252.5

Note that both of the CV and MDM meet the USGS standards for discharge measurement quality assurance (QA): CV < 5% and MDM < 5%. The results indicate that the StreamPro provides repeatable and accurate discharge measurements.

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