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**APAS for Windows
User's Manual**

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Introduction

This manual will familiarize the reader with the latest Ariel performance Analysis System (APAS) for Windows. The new “RealCap” module will be explained, along with “Trimming” and most importantly “Digitizing”. The manual will describe both two-dimensional and three-dimensional analysis. At the end of the manual, there are reference guides for the three modules. The reference guides present step-by-step instructions. The information described in this manual can also be obtained along with practice video files from the Ariel web site at www.arielnet.com, under the tutorials section.

RealCap, Capturing Video Files directly into APAS

The Real Cap module requires a video capture card. The one available in the Data Analysis Lab is the *Iomega* Buz card. The video camera or VCR is attached to the *Iomega* Buz with an S-video or RCA cable and positioned to capture the required movement pattern. Before capturing video the correct settings have to be entered into the RealCap module. Open the Real Cap module by clicking on the **RealCap** icon in the Ariel window.



In the view menu (Figure 1), select all of the options except for Preview. The Overlay mode should also be selected. The preview mode is for older equipment and is not needed.

In the Options menu, the video format and video source will both need to be defined. Start with the Video Format (Figure 2). Since we are using live video, the capture format is Motion JPEG. This allows the capturing of full size and full speed videos. The JPEG quality should be set at 60 Kb/frame. For digitizing purposes, there is no difference

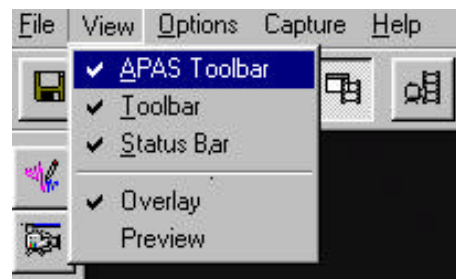


Figure 1. View menu and toolbar.

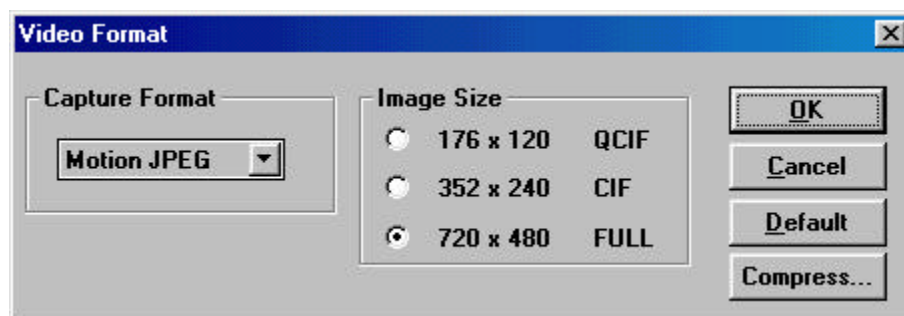


Figure 2. Video Format selection window

between 60 Kb/frame and 200 Kb/frame, but using the lower quality, allows more video to be captured. If the event being videoed is longer than 5 minutes reduce this to 33 Kb/frame. This will reduce the quality of the image, but this is necessary to be able to capture all of the information needed. The image size should be set to FULL. If the event is longer than 5 minutes reduce the image size, so as to not overfill the hard drive.

The video source set-up is specific to the *Iomega Buz*. If another video capture card is being used, please check the Ariel website for more instructions. The video standard that will be used is NTSC (USA). The *Iomega Buz* can detect the video format, so if you are unsure, click the **Detect** button. The video input is 2 S-Video but can be 1 Composite. For reflective markers and auto-digitizing, the brightness should be lower than the contrast. If you wish to digitize manually, the brightness should be higher than the contrast. Leaving the default settings, will not greatly affect the quality of your video.

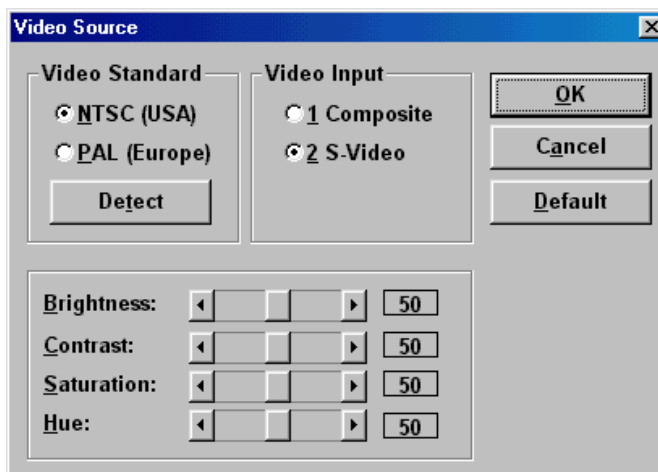


Figure 3. Video Source selection window

The next menu is the Capture menu. Before capturing starts, it is important to set the preferences. In the Capture Preferences window (Figure 4), you have to set the capture options, the

temporary file allocation and the VCR control. The frame rate is given in frames/second **not** fields/second. By capturing at 30 frames per second, you will be analysing at 60 Hz. If you are using PAL instead of NTSC, then the frame rate will be 25 frames/second and analysis will be at 50 Hz. The capture time, is the length of time required to capture the event. It is a good idea to capture for at least 1 or 2 seconds before and after the required event. You must enable the time delay, if you want the software to stop capturing at the required time. If you are unsure of the length of the event, do not enable the time

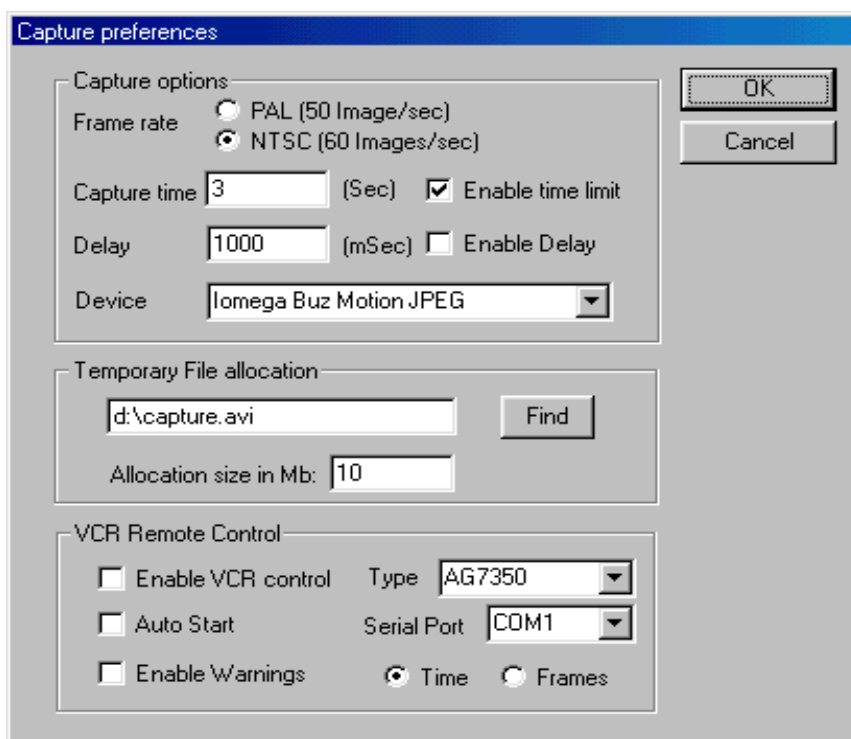


Figure 4. Capture Preferences selection window

delay. Hitting the **Esc** key during the capturing process will stop it. The delay should only be used when capturing video from a VCR source. It allows time for the VCR to start. The delay time needs to be added to the total time. To use the time delay, it must be enabled, by clicking the radio button. The device we are using is the *Iomega Buz Motion JPEG*.

The Temporary File allocation frame is used to define the space needed for a temporary data file, which is rewritten every time you collect video. It allows for contiguous disk space to be set aside to optimize real-time data transfer to the hard drive. The default file should be d:\capture.avi. The file should be allocated at least 10 Mb of memory. This will hold 3-5 seconds of video data at the moderate compression already set. The system will automatically allocate more space, if it is needed.

The VCR Remote Control frame is only needed if you are using a VCR. If you are not, do not enable VCR control. If a VCR is being used, the type of VCR needs to be selected along with the serial port it is using. Enabling Auto Start allows the computer to turn the VCR on in play mode before the start of capturing. This is used as an aid in the synchronization process.

You are now ready to capture video. To capture video make sure that the subject and laboratory equipment (force platform(s) etc.) are ready for data collection. Select the Capture Menu, and then Video Sequence. Capturing will start immediately and continue for the required time, or until the **Esc** key is pressed.

Trimming

Before digitizing the video it should be trimmed. Trimming is very important when using multiple cameras and ensures that only relevant movement is digitized. In the RealCap module, the trimming process is built-in.

The Ariel system does not require a hardware GenLock for multiple cameras. This means that the cameras do not have to start simultaneously. The trimming process acts as a software GenLock and allows synchronization of multiple camera views. Any error produced is less than one millisecond.

In trimming the video, the most important factor is selecting the synchronization frame. This frame should show an easily identifiable event from all camera views. For walking, heel strike is a good choice as the synchronization event. In the first camera view, the synchronization frame number is selected, and then the number of frames before and after the event. For the rest of the camera views, only the synchronization image needs to be selected. The number of pre and post images remains the same.

To start the trimming process, click the **Trimmer** icon.



In the **RealCap** module this is done automatically. The trimming screen can show 2, 4, 6, or 12 images on the screen at one time. Choose the page setup from the options available. Six images per screen is a good choice.

To select the sync image, the Sync radio button must be clicked on. Then move through the images and click on the image you wish to use. You could also enter the frame number underneath the Sync radio button. The frame number appears in the top left corner of the frame. To select the number of images before the synchronization event, click the Pre radio button, and enter the number of images needed. Remember that this is the number of images before the event, not the starting frame number. To select the number of images after the event, click the Post radio button and select the number of frames after the synchronization event. Once you have selected this, click **OK**. Find a place to save the video on your hard drive. Do not use the same name as the preallocated capture file, as this can cause confusion.

For multiple camera views, the number of pre and post images will remain the same. For each view, you must go and select the synchronization event only. Save all of the camera views, so that you can retrieve them when you are ready to digitize.

Digitizing Your Filmed Video

For those new to digitizing, the APAS system is straightforward and easy to master. Digitizing is used to get information on the motion that is filmed. It gives us information about velocity, angular acceleration, joint angles and body position.

Open APAS Digitizing program, click on the **Dig4** icon in the Ariel window.



Before you can start digitizing a view, you will need to select a sequence. The sequence can be one that is already designed, or it may be a new sequence. It is a good idea to set-up the sequences for similar views before the digitizing process gets started. The sequence is specific to the grid board used, and the number of markers.

To develop a new sequence, choose the sequence, new command from the file menu. You must create a new file name with the extension, .cf. You can save this file anywhere on the computer or on the network server. Sequence parameters must then be entered.

Figure 5. Sequence Parameters selection window

The sequence title (Figure 5) should accurately describe the sequence. If this is a standard sequence that will be used again, the sequence title should be easily identifiable. The units for digitizing should be in centimetres (Cm), which ever value is best suited to the video data. The number of points, is the number of markers placed on the subject. It does not include the fixed point. The number of control points, corresponds with the grid board. For three dimensional

analysis the grid board has 27 points. For two-dimensional analysis the grid board has 16 points. If you are setting up a new sequence, you must identify the data points and the control points. The data points are identified by selecting the **Point ID's** button, and then selecting the correct right/left label. If the labels do not correspond to your point, you can enter in the specific label. When the point id's are entered APAS will automatically connect the points to form the body segments. If you enter in different labels, you must build the segments, using the segment option. This allows you to connect the points. Once you have defined the segments, do not use the **Connect** button, as it will erase all user-defined segments. All of the control points coordinates have to be entered. The measurements must be in the same units as selected previously. Do not use meters for your control points, if you selected centimeters as your unit of measurement. When this has all been completed, select **OK**. The sequence will now be saved, under the file selected.

If you wish to use a previously defined sequence for control and data points, instead of defining the points, simply click the **Read...** button (Figure 5). This allows you to chose the previously digitized sequence you wish to read the information from. The entire sequence (title, units, #points, #control, type, height, weight, segment names, connections, and control point locations) will be copied to the new file you so designate. The necessary fields should be modified (title, height, weight).

If you are using a different set of markers or different order of digitizing the markers press the **Point ID's** button (Figure 5). Then select the marker names, in order, from the list provided (Figure 6).

Once the sequence is selected, you are ready to Open a New View within the sequence. Up to nine views can be used to analyze a single sequence, but only four views can be opened

simultaneously. A view refers to a particular camera's view. Four different camera views can be digitized at the same time, using the APAS system. When opening a new view, view information must be entered (see Figure 7). The title of the view should refer to the position of the subject relative to the camera. The frame rate is the number of images per second. This is 60 fields/second for the *Iomega* Buz card. The frame rate can be calculated by dividing the video speed, by the skip factor plus one. The camera ID is optional, and identifies the type of camera used. Camera X, Y, and Z defines the camera location in reference to the control points. This can help in validity checks of the data. The view type we will be using is stationary, panning cameras are not covered.

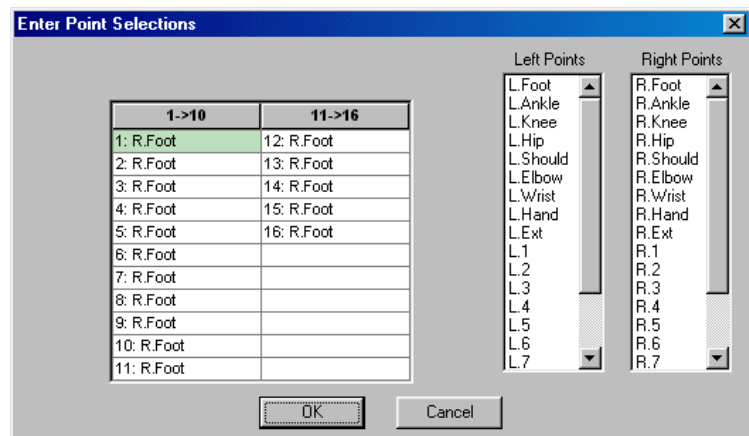


Figure 6. Point Selection window

To open the image file, select Open AVI Images, and enter the file name.

When digitizing, always start with the fixed point. Then digitize each point in order. The next point to be digitized will be labeled in the View Window Status Bar. When the current image is finished, the Status bar will indicate COMPLETE. To advance the frame, click the right mouse button.

If you wish to open multiple view files, select New View from the File menu. Enter the view information and open the corresponding image file. Then just begin digitizing. Up to four views can be digitized simultaneously. To lock the multiple views, select the LOCK command from the Images menu. This allows the images to reverse and/or advance at the same rate. The current status of the LOCK function is shown in the Status bar.

If points are digitized incorrectly, they can be corrected by selecting the Correct command in the Images menu. This allows the last point to be reversed. The middle cursor button also reverses the last point. The Erase All command in the Images menu, will erase all points in the current image.

Points that can not be digitized should be entered as missing by selecting the Missing command from the Images menu. For some camera views not all points will be seen. This is all right. As long as at least two cameras see each point in every image, interpolation will not be needed. APAS can use linear interpolation to determine the location of the point.

When all points are visible all the time, fully automatic digitizing can be used. This is done by selecting the Automatic option on the command bar. Three dimensional analysis is also possible by selecting the 3D option from the command bar.

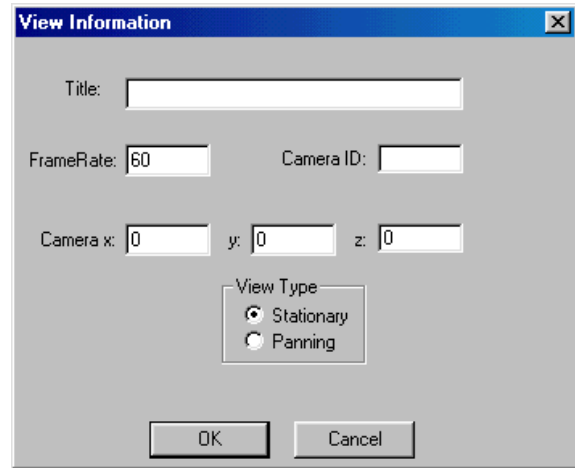


Figure 7. View Information window

Table of Hot Keys

The following chart shows the active hot keys for digitizing, and is a handy reference tool.

Key

DEL
CTRL-DEL
ESC
ALT-LEFT
ALT-RIGHT
ALT-0
ALT-1
ALT-2
ALT-3
ALT-4

Function

Correct Previous Point
Erase all points in frame
Set current point to missing
Backup one image
Advance to next image
Zoom .5x
Zoom 1x
Zoom 2x
Zoom 3x
Zoom 4x

Mouse Action

Left Button
CTRL-Left button
Shift- Left Button
CTRL-Shift- Left Button
Right Button
Right Double Click
Middle Button

Digitize
Drag Point
Relocate Specific point
Auto Locate Current Point
Return Cursor to Expected Location
Advance to next field
Delete/Correct last point

Using Imager

Imager is the program that allows us to look at the stick-figures that we've created and make sure that everything is OK. It was written by Dr. Robertson of the University of Ottawa.

- 1) Open the **Biomech System Folder**.
- 2) Double click on **Imager for Windows**.
- 3) Find your file in the data directory. There will be two files, one with a **1t** (or **2t, 3t, ... 9t**) extension and one with a **cf** extension.
- 4) Under Imager data files, select your file and press the **View and Edit, View, Edit & Convert** or **Animate only** buttons. If you plan to use the data with the Biomech Motion Analysis System use the **View, Edit & Convert** button. Double-clicking on the file is the same as pressing, **Animate only**. Press enter after every prompt.
- 5) You should now see your stick-figures.
- 6) Edit your images, if there are any missing or erroneous points. You cannot edit the images if you used the **Animate only** button in step 4.
- 7) If you are planning to use the Biomech system you can also add event codes to identify ipsilateral toe-off and foot-strike (ITO, IFS), contralateral toe-off and foot-strike (CTO, CFS) or other types of events.
- 8) Save your modifications by pressing, **W**.