nestedSequencer4 Report

4th October 2016

1 ID Files

1.1 MissionIds

$\mathbf{section}\ MissionIds\ \mathbf{parents}\ scj\_prelude, MissionId$

$$
\begin{array}{|l}
TopMissionMID : MissionID \\
MidMissionMID : MissionID \\
BottomMissionAMID : MissionID \\
BottomMissionBMID : MissionID \\
\hline
distinct \langle nullMissionId, TopMissionMID, MidMissionMID, \\
BottomMissionAMID, BottomMissionBMID \rangle
\end{array}
$$

1.2 SchedulablesIds

section *SchedulableIds* **parents** *scj_prelude*, *SchedulableId*

$$
\begin{array}{|l}
\mathit{TopSequencerSID} : \mathit{SchedulableID} \\
\mathit{MT1SID} : \mathit{SchedulableID} \\
\mathit{MidMissionSequencerSID} : \mathit{SchedulableID} \\
\mathit{BottomMissionSequencerASID} : \mathit{SchedulableID} \\
\mathit{BottomMissionSequencerBSID} : \mathit{SchedulableID} \\
\mathit{MT2SID} : \mathit{SchedulableID} \\
\mathit{MT3SID} : \mathit{SchedulableID} \\
\hline
\mathit{distinct}\langle \mathit{nullSequencerId}, \mathit{nullSchedulableId}, \mathit{TopSequencerSID}, \\
\mathit{MT1SID}, \mathit{MidMissionSequencerSID}, \\
\mathit{BottomMissionSequencerASID}, \mathit{BottomMissionSequencerBSID}, \\
\mathit{MT2SID}, \mathit{MT3SID}\rangle
\end{array}
$$

2 Network

2.1 Network Channel Sets

section $NetworkChannels$ **parents** $scj\_prelude, MissionId, MissionIds,$
$SchedulableId, SchedulableIds, MissionChan, TopLevelMissionSequencerFWChan,$
$FrameworkChan, SafeletChan, AperiodicEventHandlerChan, ManagedThreadChan,$
$OneShotEventHandlerChan, PeriodicEventHandlerChan, MissionSequencerMethChan$

channelset $TerminateSync ==$
$\{\| schedulables\_terminated, schedulables\_stopped, get\_activeSchedulables \|\}$

channelset $ControlTierSync ==$
$\{\| start\_toplevel\_sequencer, done\_toplevel\_sequencer, done\_safeletFW \|\}$

channelset $TierSync ==$
$\{\| start\_mission \,.\, TopMission, done\_mission \,.\, TopMission,$
$done\_safeletFW, done\_toplevel\_sequencer \|\}$

channelset $MissionSync ==$
$\{\| done\_safeletFW, done\_toplevel\_sequencer, register,$
$signalTerminationCall, signalTerminationRet, activate\_schedulables, done\_schedulable,$
$cleanupSchedulableCall, cleanupSchedulableRet \|\}$

channelset $SchedulablesSync ==$
$\{\| activate\_schedulables, done\_safeletFW, done\_toplevel\_sequencer \|\}$

channelset $ClusterSync ==$
$\{\| done\_toplevel\_sequencer, done\_safeletFW \|\}$

channelset $SafeltAppSync \mathrel{\widehat{=}}$
$\{\| getSequencerCall, getSequencerRet, initializeApplicationCall, initializeApplicationRet, end\_safelet\_app \|\}$

channelset $MissionSequencerAppSync ==$
$\{\| getNextMissionCall, getNextMissionRet, end\_sequencer\_app \|\}$

channelset $MissionAppSync ==$
$\{\| initializeCall, register, initializeRet, cleanupMissionCall, cleanupMissionRet \|\}$

channelset $AppSync ==$
$\bigcup\{SafeltAppSync, MissionSequencerAppSync, MissionAppSync,$
$MTAppSync, OSEHSync, APEHSync, PEHSync,$
$\{\| getSequencer, end\_mission\_app, end\_managedThread\_app,$
$setCeilingPriority, requestTerminationCall, requestTerminationRet, terminationPendingCall,$
$terminationPendingRet, handleAsyncEventCall, handleAsyncEventRet \|\}\}$

channelset $ThreadSync ==$
$\{\| raise\_thread\_priority, lower\_thread\_priority, isInterruptedCall, isInterruptedRet, get\_priorityLevel \|\}$

channelset $LockingSync ==$
$\{\| lockAcquired, startSyncMeth, endSyncMeth, waitCall, waitRet, notify, isInterruptedCall, isInterruptedRet,$
$interruptedCall, interruptedRet, done\_toplevel\_sequencer, get\_priorityLevel \|\}$

channelset $Tier0Sync ==$

$$\begin{array}{l}
\{\!|\ done\_toplevel\_sequencer, done\_safeletFW, \\
start\_mission . MidMission, done\_mission . MidMission, \\
initializeRet . MidMission, requestTermination . MidMission . TopSequencer\ |\!\}
\end{array}$$

channelset $Tier1Sync ==$

$$\begin{array}{l}
\{\!|\ done\_toplevel\_sequencer, done\_safeletFW, \\
start\_mission . BottomMissionA, done\_mission . BottomMissionA, \\
initializeRet . BottomMissionA, requestTermination . BottomMissionA .\ |\!\}
\end{array}$$

channelset $Tier2Sync ==$

$$\begin{array}{l}
\{\!|\ done\_toplevel\_sequencer, done\_safeletFW, \\
start\_mission . BottomMissionB, done\_mission . BottomMissionB, \\
initializeRet . BottomMissionB, requestTermination . BottomMissionB .\ |\!\}
\end{array}$$

2.2 Locking

$\mathbf{section}\ NetworkLocking\ \mathbf{parents}\ scj\_prelude, GlobalTypes, FrameworkChan, MissionId, MissionIds,$
$ThreadIds, NetworkChannels, ObjectFW, ThreadFW$

$\mathbf{process}\ Threads \mathrel{\widehat=}$
$(\mathbf{Skip})$

$\mathbf{process}\ Objects \mathrel{\widehat=}$
$(\mathbf{Skip})$

$\mathbf{process}\ Locking \mathrel{\widehat=} Threads \llbracket ThreadSync \rrbracket Objects$

2.3 Program

$$\begin{array}{l}
\mathbf{section}\ \mathit{Program}\ \mathbf{parents}\ \mathit{scj\_prelude}, \mathit{MissionId}, \mathit{MissionIds}, \\
\quad \mathit{SchedulableId}, \mathit{SchedulableIds}, \mathit{MissionChan}, \mathit{SchedulableMethChan}, \mathit{MissionFW}, \\
\quad \mathit{SafeletFW}, \mathit{TopLevelMissionSequencerFW}, \mathit{NetworkChannels}, \mathit{ManagedThreadFW}, \\
\quad \mathit{SchedulableMissionSequencerFW}, \mathit{PeriodicEventHandlerFW}, \mathit{OneShotEventHandlerFW}, \\
\quad \mathit{AperiodicEventHandlerFW}, \mathit{ObjectFW}, \mathit{ThreadFW}, \\
\quad \mathit{MyAppApp}, \mathit{TopSequencerApp}, \mathit{TopMissionApp}, \mathit{MT1App}, \mathit{MidMissionSequencerApp} \\
\quad , \mathit{MidMissionApp}, \mathit{BottomMissionSequencerAApp}, \mathit{BottomMissionSequencerBApp} \\
\quad , \mathit{BottomMissionAApp}, \mathit{MT2App}, \mathit{BottomMissionBApp}, \mathit{MT3App}
\end{array}$$

$$\begin{array}{l}
\mathbf{process}\ \mathit{ControlTier} \mathrel{\widehat=} \\
\left(\begin{array}{l}
\mathit{SafeletFW} \\
\quad \llbracket \mathit{ControlTierSync} \rrbracket \\
\mathit{TopLevelMissionSequencerFW}(\mathit{TopSequencer})
\end{array}\right)
\end{array}$$

$$\begin{array}{l}
\mathbf{process}\ \mathit{Tier0} \mathrel{\widehat=} \\
\left(\begin{array}{l}
\mathit{MissionFW}(\mathit{TopMissionID}) \\
\quad \llbracket \mathit{MissionSync} \rrbracket \\
\left(\begin{array}{l}
\mathit{ManagedThreadFW}(\mathit{MT1ID}) \\
\quad \llbracket \mathit{SchedulablesSync} \rrbracket \\
\mathit{SchedulableMissionSequencerFW}(\mathit{MidMissionSequencerID})
\end{array}\right)
\end{array}\right)
\end{array}$$

$$\begin{array}{l}
\mathbf{process}\ \mathit{Tier1} \mathrel{\widehat=} \\
\left(\begin{array}{l}
\mathit{MissionFW}(\mathit{MidMissionID}) \\
\quad \llbracket \mathit{MissionSync} \rrbracket \\
\left(\begin{array}{l}
\mathit{OneShotEventHandlerFW}(\mathit{BottomMissionSequencerAID}) \\
\quad \llbracket \mathit{SchedulablesSync} \rrbracket \\
\mathit{SchedulableMissionSequencerFW}(\mathit{BottomMissionSequencerBID})
\end{array}\right)
\end{array}\right)
\end{array}$$

$$\begin{array}{l}
\mathbf{process}\ \mathit{Tier2} \mathrel{\widehat=} \\
\left(\begin{array}{l}
\mathit{MissionFW}(\mathit{BottomMissionAID}) \\
\quad \llbracket \mathit{MissionSync} \rrbracket \\
(\mathit{ManagedThreadFW}(\mathit{MT2ID}))
\end{array}\right)
\end{array}$$

$$\begin{array}{l}
\mathbf{process}\ \mathit{Tier3} \mathrel{\widehat=} \\
\left(\begin{array}{l}
\mathit{MissionFW}(\mathit{BottomMissionBID}) \\
\quad \llbracket \mathit{MissionSync} \rrbracket \\
(\mathit{ManagedThreadFW}(\mathit{MT3ID}))
\end{array}\right)
\end{array}$$

$$\begin{array}{l}
\mathbf{process}\ \mathit{Framework} \mathrel{\widehat=} \\
\left(\begin{array}{l}
\mathit{ControlTier} \\
\quad \llbracket \mathit{TierSync} \rrbracket \\
\left(\begin{array}{l}
\mathit{Tier0} \\
\quad \llbracket \mathit{Tier0Sync} \rrbracket \\
\mathit{Tier1} \\
\quad \llbracket \mathit{Tier1Sync} \rrbracket \\
\mathit{Tier2} \\
\quad \llbracket \mathit{Tier2Sync} \rrbracket \\
\mathit{Tier3}
\end{array}\right)
\end{array}\right)
\end{array}$$

$$\mathbf{process}\ Application \mathrel{\widehat=}$$
$$\left(\begin{array}{l}MyAppApp\\ \interleave\\ TopSequencerApp\\ \interleave\\ TopMissionApp\\ \interleave\\ MT1App\\ \interleave\\ MidMissionSequencerApp\\ \interleave\\ MidMissionApp\\ \interleave\\ BottomMissionSequencerAApp\\ \interleave\\ BottomMissionSequencerBApp\\ \interleave\\ BottomMissionAApp\\ \interleave\\ MT2App\\ \interleave\\ BottomMissionBApp\\ \interleave\\ MT3App\end{array}\right)$$

$$\mathbf{process}\ Program \mathrel{\widehat=} \big(Framework \llbracket AppSync \rrbracket Application\big) \llbracket LockingSync \rrbracket Locking$$

3 Safelet

section $MyAppApp$ **parents** $scj\_prelude, SchedulableId, SchedulableIds, SafeletChan, MethodCallBindingChannels$

process $MyAppApp \mathrel{\widehat=}$ **begin**

$$InitializeApplication \mathrel{\widehat=} \\ \left(\begin{array}{l} initializeApplicationCall \longrightarrow \\ initializeApplicationRet \longrightarrow \\ \mathbf{Skip} \end{array}\right)$$

$$GetSequencer \mathrel{\widehat=} \\ \left(\begin{array}{l} getSequencerCall \longrightarrow \\ getSequencerRet\,!\,TopSequencerSID \longrightarrow \\ \mathbf{Skip} \end{array}\right)$$

$$Methods \mathrel{\widehat=} \\ \left(\begin{array}{l} GetSequencer \\ \Box \\ InitializeApplication \end{array}\right) \mathbin{;}\ Methods$$

$\bullet\ (Methods) \mathbin{\triangle} (end\_safelet\_app \longrightarrow \mathbf{Skip})$

end

4 Top Level Mission Sequencer

$\textbf{section}\ \mathit{TopSequencerApp}\ \textbf{parents}\ \mathit{TopLevelMissionSequencerChan},$
$\quad \mathit{MissionId}, \mathit{MissionIds}, \mathit{SchedulableId}, \mathit{SchedulableIds}, \mathit{TopSequencerClass}, \mathit{MethodCallBindingChannels}$

$\textbf{process}\ \mathit{TopSequencerApp} \mathrel{\widehat=}$
$\quad \mathit{name} : \mathit{String} \bullet \textbf{begin}$

$$\begin{array}{|l}
\multicolumn{1}{l}{\mathit{State}} \\
\hline
\mathit{this} : \textbf{ref}\ \mathit{TopSequencerClass} \\
\hline
\end{array}$$

$\textbf{state}\ \mathit{State}$

$$\begin{array}{|l}
\multicolumn{1}{l}{\mathit{Init}} \\
\hline
\mathit{State}\,' \\
\hline
\mathit{this}' = \textbf{new}\ \mathit{TopSequencerClass}() \\
\hline
\end{array}$$

$$\begin{array}{l}
\mathit{GetNextMission} \mathrel{\widehat=} \textbf{var}\ \mathit{ret} : \mathit{MissionID} \bullet \\
\left(\begin{array}{l}
\mathit{getNextMissionCall}\,.\,\mathit{TopSequencerSID} \longrightarrow \\
\mathit{ret} := \mathit{this}\,.\,\mathit{getNextMission}(); \\
\mathit{getNextMissionRet}\,.\,\mathit{TopSequencerSID}\,!\,\mathit{ret} \longrightarrow \\
\textbf{Skip}
\end{array}\right)
\end{array}$$

$$\begin{array}{l}
\mathit{Methods} \mathrel{\widehat=} \\
\left(\mathit{GetNextMission}\right)\ ;\ \mathit{Methods}
\end{array}$$

$$\bullet\ (\mathit{Init}\ ;\ \mathit{Methods}) \mathbin{\triangle} (\mathit{end\_sequencer\_app}\,.\,\mathit{TopSequencerSID} \longrightarrow \textbf{Skip})$$

end

section *TopSequencerClass* **parents** *scj_prelude*, *SchedulableId*, *SchedulableIds*, *SafeletChan*
, *MethodCallBindingChannels*, *MissionId*, *MissionIds*

class *TopSequencerClass* $\widehat{=}$ **begin**

state *State*

$$\begin{array}{|l}
notReleased : \mathbb{B}
\end{array}$$

state *State*

initial *Init*

$$\begin{array}{|l}
State~' \\
\hline
notReleased = \mathbf{True}
\end{array}$$

$$\mathbf{protected}\ getNextMission\ \widehat{=}\ \mathbf{var}\ ret : MissionID \bullet$$
$$\left(\begin{array}{l}
\mathbf{if}\ notReleased = \mathbf{True} \longrightarrow \\
\qquad \left(\begin{array}{l} notReleased := \mathbf{False}; \\ ret := TopMissionMID \end{array}\right) \\
[\!]\ \neg\ notReleased = \mathbf{True} \longrightarrow \\
\qquad \left(ret := nullMissionId\right) \\
\mathbf{fi}
\end{array}\right)$$

$\bullet$ **Skip**

end

5 Missions

5.1 TopMission

$$\mathbf{section}\ TopMissionApp\ \mathbf{parents}\ scj\_prelude, MissionId, MissionIds, \\ \quad SchedulableId, SchedulableIds, MissionChan, SchedulableMethChan, TopMissionMethChan \\ , MethodCallBindingChannels$$

$$\mathbf{process}\ TopMissionApp \mathrel{\widehat=} \mathbf{begin}$$

$$\begin{array}{l} InitializePhase \mathrel{\widehat=} \\ \left(\begin{array}{l} initializeCall\,.\,TopMissionMID \longrightarrow \\ register\,!\,MT1SID\,!\,TopMissionMID \longrightarrow \\ register\,!\,MidMissionSequencerSID\,!\,TopMissionMID \longrightarrow \\ initializeRet\,.\,TopMissionMID \longrightarrow \\ \mathbf{Skip} \end{array}\right) \end{array}$$

$$\begin{array}{l} CleanupPhase \mathrel{\widehat=} \\ \left(\begin{array}{l} \mathbf{var}\,\mathbb{B} : ret \bullet cleanupMissionCall\,.\,TopMissionMID \longrightarrow \\ cleanupMissionRet\,.\,TopMissionMID\,!\,\mathbf{True} \longrightarrow \\ \mathbf{Skip} \end{array}\right) \end{array}$$

$$Methods \mathrel{\widehat=} \left(\begin{array}{l} InitializePhase \\ \Box \\ CleanupPhase \end{array}\right) \mathrel{;}\ Methods$$

$$\bullet\ (Init \mathrel{;}\ Methods) \mathbin{\triangle} (end\_mission\_app\,.\,TopMissionMID \longrightarrow \mathbf{Skip})$$

$$\mathbf{end}$$

5.2 Schedulables of TopMission

section $MT1App$ **parents** $ManagedThreadChan, SchedulableId, SchedulableIds, MethodCallBindingChannels$

process $MT1App \mathrel{\widehat=}$ **begin**

$$Run \mathrel{\widehat=} \left(\begin{array}{l} runCall\,.\,MT1SID \longrightarrow \\ \mathbf{Skip}; \\ runRet\,.\,MT1SID \longrightarrow \\ \mathbf{Skip} \end{array}\right)$$

$$Methods \mathrel{\widehat=} \big(Run\big)\ ;\ \ Methods$$

$$\bullet\ (Methods) \bigtriangleup (end\_managedThread\_app\,.\,MT1SID \longrightarrow \mathbf{Skip})$$

end

section $\mathit{MidMissionSequencerApp}$ **parents** $\mathit{TopLevelMissionSequencerChan}$,
$\mathit{MissionId}, \mathit{MissionIds}, \mathit{SchedulableId}, \mathit{SchedulableIds}, \mathit{MidMissionSequencerClass}, \mathit{MethodCallBindingChannels}$

process $\mathit{MidMissionSequencerApp} \mathrel{\widehat=}$
$\mathit{name} : \mathit{String} \bullet$ **begin**

$$\mathit{GetNextMission} \mathrel{\widehat=} \mathbf{var}\ \mathit{ret} : \mathit{MissionID} \bullet$$
$$\left(\begin{array}{l}\mathit{getNextMissionCall} \,.\, \mathit{MidMissionSequencerSID} \longrightarrow \\ \mathit{ret} := \mathit{this} \,.\, \mathit{getNextMission}(); \\ \mathit{getNextMissionRet} \,.\, \mathit{MidMissionSequencerSID} \,!\, \mathit{ret} \longrightarrow \\ \mathbf{Skip}\end{array}\right)$$

$$\mathit{Methods} \mathrel{\widehat=}$$
$$\left(\mathit{GetNextMission}\right) \;;\; \mathit{Methods}$$

$$\bullet\ (\mathit{Methods}) \mathbin{\triangle} (\mathit{end\_sequencer\_app} \,.\, \mathit{MidMissionSequencerSID} \longrightarrow \mathbf{Skip})$$

end

$\mathbf{section}\ MidMissionSequencerClass\ \mathbf{parents}\ scj\_prelude, SchedulableId, SchedulableIds, SafeletChan$
$, MethodCallBindingChannels, MissionId, MissionIds$

$\mathbf{class}\ MidMissionSequencerClass \mathrel{\widehat=} \mathbf{begin}$

$$\begin{array}{|l}
\multicolumn{1}{l}{\mathbf{state}\ State} \\ \hline
notReleased : \mathbb{B} \\ \hline
\end{array}$$

$\mathbf{state}\ State$

$$\begin{array}{|l}
\multicolumn{1}{l}{\mathbf{initial}\ Init} \\ \hline
State\,' \\ \hline
notReleased = \mathbf{True} \\ \hline
\end{array}$$

$\mathbf{protected}\ getNextMission \mathrel{\widehat=} \mathbf{var}\ ret : MissionID \bullet$

$$\left(\begin{array}{l}
\mathbf{if}\ notReleased = \mathbf{True} \longrightarrow \\
\qquad \left(\begin{array}{l} notReleased := \mathbf{False}; \\ ret := MidMissionMID \end{array}\right) \\
[\!] \neg\ notReleased = \mathbf{True} \longrightarrow \\
\qquad \left(ret := nullMissionId\right) \\
\mathbf{fi}
\end{array}\right)$$

$\bullet\ \mathbf{Skip}$

$\mathbf{end}$

5.3 MidMission

section $MidMissionApp$ **parents** $scj\_prelude, MissionId, MissionIds,$
$SchedulableId, SchedulableIds, MissionChan, SchedulableMethChan, MidMissionMethChan$
$, MethodCallBindingChannels$

process $MidMissionApp \mathrel{\widehat=}$ **begin**

$$InitializePhase \mathrel{\widehat=}$$
$$\left(\begin{array}{l} initializeCall\,.\,MidMissionMID \longrightarrow \\ register\,!\,BottomMissionSequencerASID\,!\,MidMissionMID \longrightarrow \\ register\,!\,BottomMissionSequencerBSID\,!\,MidMissionMID \longrightarrow \\ initializeRet\,.\,MidMissionMID \longrightarrow \\ \mathbf{Skip} \end{array}\right)$$

$$CleanupPhase \mathrel{\widehat=}$$
$$\left(\begin{array}{l} \mathbf{var}\,\mathbb{B} : ret \bullet cleanupMissionCall\,.\,MidMissionMID \longrightarrow \\ cleanupMissionRet\,.\,MidMissionMID\,!\,\mathbf{True} \longrightarrow \\ \mathbf{Skip} \end{array}\right)$$

$$Methods \mathrel{\widehat=} \left(\begin{array}{l} InitializePhase \\ \Box \\ CleanupPhase \end{array}\right) ; \; Methods$$

$$\bullet\ (Init \, ; \; Methods) \mathbin{\triangle} (end\_mission\_app\,.\,MidMissionMID \longrightarrow \mathbf{Skip})$$

end

5.4 Schedulables of MidMission

$\mathbf{section}\ BottomMissionSequencerAApp\ \mathbf{parents}\ TopLevelMissionSequencerChan,$
$\quad MissionId, MissionIds, SchedulableId, SchedulableIds, BottomMissionSequencerAClass, MethodCallBindingChannels$

$\mathbf{process}\ BottomMissionSequencerAApp \mathrel{\widehat=}$
$\quad name : String \bullet \mathbf{begin}$

$$GetNextMission \mathrel{\widehat=} \mathbf{var}\ ret : MissionID \bullet$$
$$\left(\begin{array}{l} getNextMissionCall \,.\, BottomMissionSequencerASID \longrightarrow \\ ret := this \,.\, getNextMission(); \\ getNextMissionRet \,.\, BottomMissionSequencerASID \,!\, ret \longrightarrow \\ \mathbf{Skip} \end{array}\right)$$

$$Methods \mathrel{\widehat=}$$
$$\big(GetNextMission \big) \;;\; Methods$$

$$\bullet\ (Methods) \mathbin{\triangle} (end\_sequencer\_app \,.\, BottomMissionSequencerASID \longrightarrow \mathbf{Skip})$$

$\mathbf{end}$

section *BottomMissionSequencerAClass* **parents** *scj_prelude*, *SchedulableId*, *SchedulableIds*, *SafeletChan*, *MethodCallBindingChannels*, *MissionId*, *MissionIds*

class *BottomMissionSequencerAClass* $\widehat{=}$ **begin**

state *State*

$notReleased : \mathbb{B}$

state *State*

initial *Init*

$State~'$

$notReleased = \mathbf{True}$

$$
\mathbf{protected}\ getNextMission\ \widehat{=}\ \mathbf{var}\ ret : MissionID \bullet
\left(\begin{array}{l}
\mathbf{if}\ notReleased = \mathbf{True} \longrightarrow \\
\qquad \left(\begin{array}{l} notReleased := \mathbf{False}; \\ ret := BottomMissionAMID \end{array}\right) \\
[\!]\ \neg\ notReleased = \mathbf{True} \longrightarrow \\
\qquad \left(ret := nullMissionId \right) \\
\mathbf{fi}
\end{array}\right)
$$

$\bullet$ **Skip**

end

section *BottomMissionSequencerBApp* **parents** *TopLevelMissionSequencerChan*,
MissionId, *MissionIds*, *SchedulableId*, *SchedulableIds*, *BottomMissionSequencerBClass*, *MethodCallBindingChannels*

$$\mathbf{process}\ BottomMissionSequencerBApp \mathrel{\widehat=} \\ \quad name : String \bullet \mathbf{begin}$$

$$GetNextMission \mathrel{\widehat=} \mathbf{var}\ ret : MissionID \bullet \\ \left(\begin{array}{l} getNextMissionCall \,.\, BottomMissionSequencerBSID \longrightarrow \\ ret := this \,.\, getNextMission(); \\ getNextMissionRet \,.\, BottomMissionSequencerBSID \,!\, ret \longrightarrow \\ \mathbf{Skip} \end{array}\right)$$

$$Methods \mathrel{\widehat=} \\ \big(GetNextMission\big) \ ; \ Methods$$

$$\bullet\ (Methods) \mathbin{\triangle} (end\_sequencer\_app \,.\, BottomMissionSequencerBSID \longrightarrow \mathbf{Skip})$$

end

section *BottomMissionSequencerBClass* **parents** *scj_prelude*, *SchedulableId*, *SchedulableIds*, *SafeletChan*, *MethodCallBindingChannels*, *MissionId*, *MissionIds*

class *BottomMissionSequencerBClass* $\widehat{=}$ **begin**

$$\begin{array}{|l}
\multicolumn{1}{l}{\textbf{state}\ State} \\
notReleased : \mathbb{B} \\
\hline
\end{array}$$

state *State*

$$\begin{array}{|l}
\multicolumn{1}{l}{\textbf{initial}\ Init} \\
State' \\
\hline
notReleased = \mathbf{True} \\
\hline
\end{array}$$

$$\textbf{protected}\ getNextMission\ \widehat{=}\ \textbf{var}\ ret : MissionID \bullet \\
\left(\begin{array}{l}
\textbf{if}\ notReleased = \mathbf{True} \longrightarrow \\
\qquad \left(\begin{array}{l} notReleased := \mathbf{False}; \\ ret := BottomMissionBMID \end{array}\right) \\
[\!]\ \neg\ notReleased = \mathbf{True} \longrightarrow \\
\qquad \left(ret := nullMissionId\right) \\
\textbf{fi}
\end{array}\right)$$

$\bullet$ **Skip**

end

5.5 BottomMissionA

section $\mathit{BottomMissionAApp}$ **parents** $\mathit{scj\_prelude}, \mathit{MissionId}, \mathit{MissionIds},$
$\mathit{SchedulableId}, \mathit{SchedulableIds}, \mathit{MissionChan}, \mathit{SchedulableMethChan}, \mathit{BottomMissionAMethChan}$
$, \mathit{MethodCallBindingChannels}$

process $\mathit{BottomMissionAApp} \mathrel{\widehat=}$ **begin**

$$\mathit{InitializePhase} \mathrel{\widehat=}$$
$$\left(\begin{array}{l}\mathit{initializeCall} \,.\, \mathit{BottomMissionAMID} \longrightarrow \\ \mathit{register} \,!\, \mathit{MT2SID} \,!\, \mathit{BottomMissionAMID} \longrightarrow \\ \mathit{initializeRet} \,.\, \mathit{BottomMissionAMID} \longrightarrow \\ \mathbf{Skip}\end{array}\right)$$

$$\mathit{CleanupPhase} \mathrel{\widehat=}$$
$$\left(\begin{array}{l}\mathbf{var}\, \mathbb{B} : \mathit{ret} \bullet \mathit{cleanupMissionCall} \,.\, \mathit{BottomMissionAMID} \longrightarrow \\ \mathit{cleanupMissionRet} \,.\, \mathit{BottomMissionAMID} \,!\, \mathbf{True} \longrightarrow \\ \mathbf{Skip}\end{array}\right)$$

$$\mathit{Methods} \mathrel{\widehat=} \left(\begin{array}{l}\mathit{InitializePhase} \\ \Box \\ \mathit{CleanupPhase}\end{array}\right) ; \ \mathit{Methods}$$

$$\bullet\ (\mathit{Init}\ ; \ \mathit{Methods}) \bigtriangleup (\mathit{end\_mission\_app} \,.\, \mathit{BottomMissionAMID} \longrightarrow \mathbf{Skip})$$

end

5.6 Schedulables of BottomMissionA

section $MT2App$ **parents** $ManagedThreadChan, SchedulableId, SchedulableIds, MethodCallBindingChannels$

process $MT2App \mathrel{\widehat=}$ **begin**

$$Run \mathrel{\widehat=} \left(\begin{array}{l} runCall \,.\, MT2SID \longrightarrow \\ \mathbf{Skip}; \\ runRet \,.\, MT2SID \longrightarrow \\ \mathbf{Skip} \end{array}\right)$$

$$Methods \mathrel{\widehat=} \big(Run\big) \;;\; Methods$$

$\bullet\ (Methods) \mathbin{\triangle} (end\_managedThread\_app \,.\, MT2SID \longrightarrow \mathbf{Skip})$

end

5.7 BottomMissionB

section *BottomMissionBApp* **parents** *scj_prelude*, *MissionId*, *MissionIds*,
SchedulableId, *SchedulableIds*, *MissionChan*, *SchedulableMethChan*, *BottomMissionBMethChan*
, *MethodCallBindingChannels*

$$\mathbf{process}\ BottomMissionBApp \mathrel{\widehat=} \mathbf{begin}$$

$$InitializePhase \mathrel{\widehat=}$$
$$\left(\begin{array}{l} initializeCall\,.\,BottomMissionBMID \longrightarrow \\ register\,!\,MT3SID\,!\,BottomMissionBMID \longrightarrow \\ initializeRet\,.\,BottomMissionBMID \longrightarrow \\ \mathbf{Skip} \end{array}\right)$$

$$CleanupPhase \mathrel{\widehat=}$$
$$\left(\begin{array}{l} \mathbf{var}\ \mathbb{B} : ret \bullet cleanupMissionCall\,.\,BottomMissionBMID \longrightarrow \\ cleanupMissionRet\,.\,BottomMissionBMID\,!\,\mathbf{True} \longrightarrow \\ \mathbf{Skip} \end{array}\right)$$

$$Methods \mathrel{\widehat=} \left(\begin{array}{l} InitializePhase \\ \Box \\ CleanupPhase \end{array}\right) ;\ Methods$$

$$\bullet\ (Init\ ;\ Methods) \mathbin{\triangle} (end\_mission\_app\,.\,BottomMissionBMID \longrightarrow \mathbf{Skip})$$

end

5.8 Schedulables of BottomMissionB

section $MT3App$ **parents** $ManagedThreadChan, SchedulableId, SchedulableIds, MethodCallBindingChannels$

process $MT3App \mathrel{\widehat=}$ **begin**

$$Run \mathrel{\widehat=} \left(\begin{array}{l} runCall\,.\,MT3SID \longrightarrow \\ \mathbf{Skip}; \\ runRet\,.\,MT3SID \longrightarrow \\ \mathbf{Skip} \end{array}\right)$$

$$Methods \mathrel{\widehat=} \left(Run\right)\ ;\ \ Methods$$

$$\bullet\ (Methods) \mathbin{\triangle} (end\_managedThread\_app\,.\,MT3SID \longrightarrow \mathbf{Skip})$$

end