Simulation use in development of ECM drills

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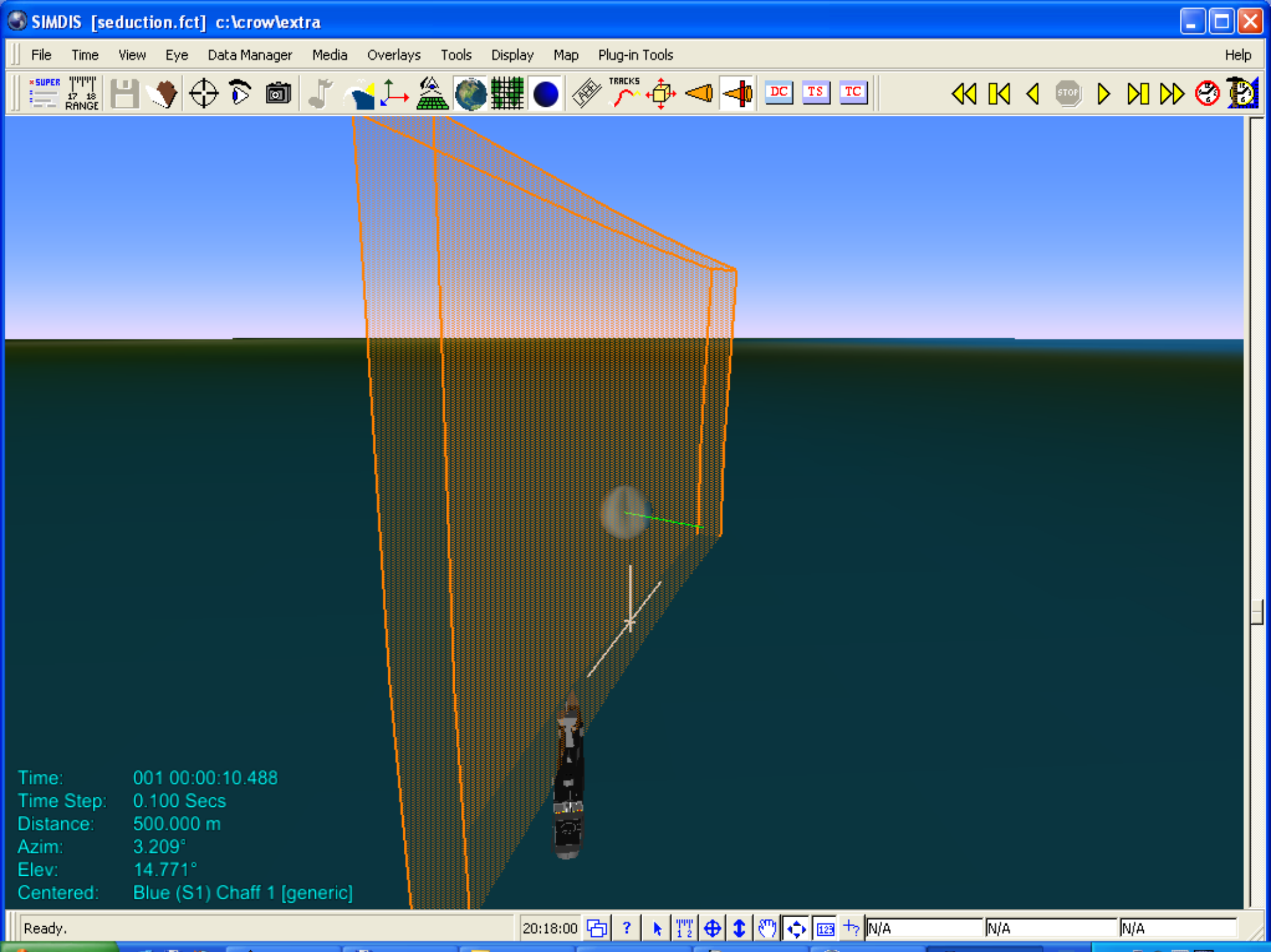
IMT

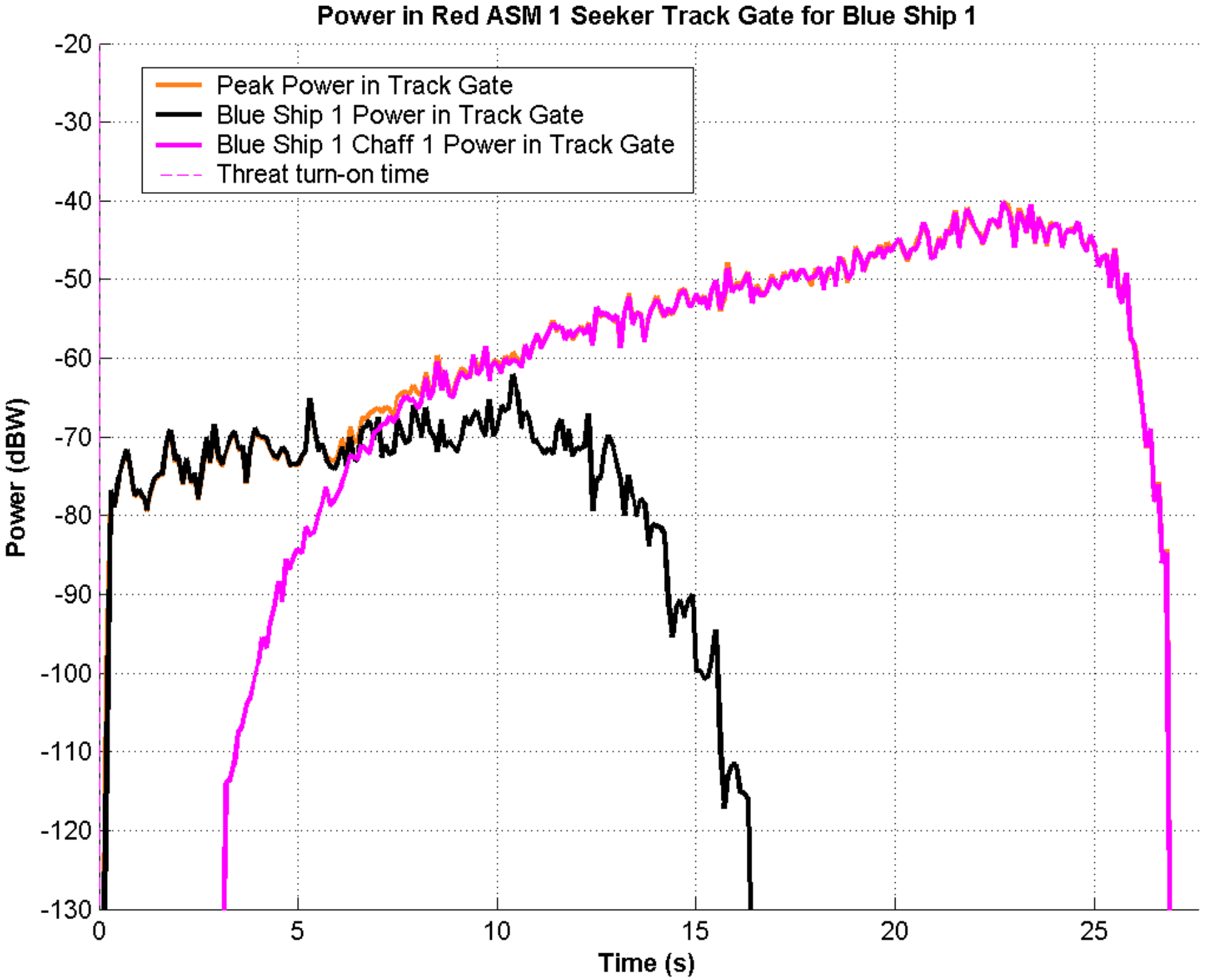
Overview

- What is seduction chaff?
- What is an ECM “Drill”
- Entities and systems involved
- Ship Air Defence Model
- IMT's external C2 module
- Simulation results
- Future of chaff

What is seduction chaff?

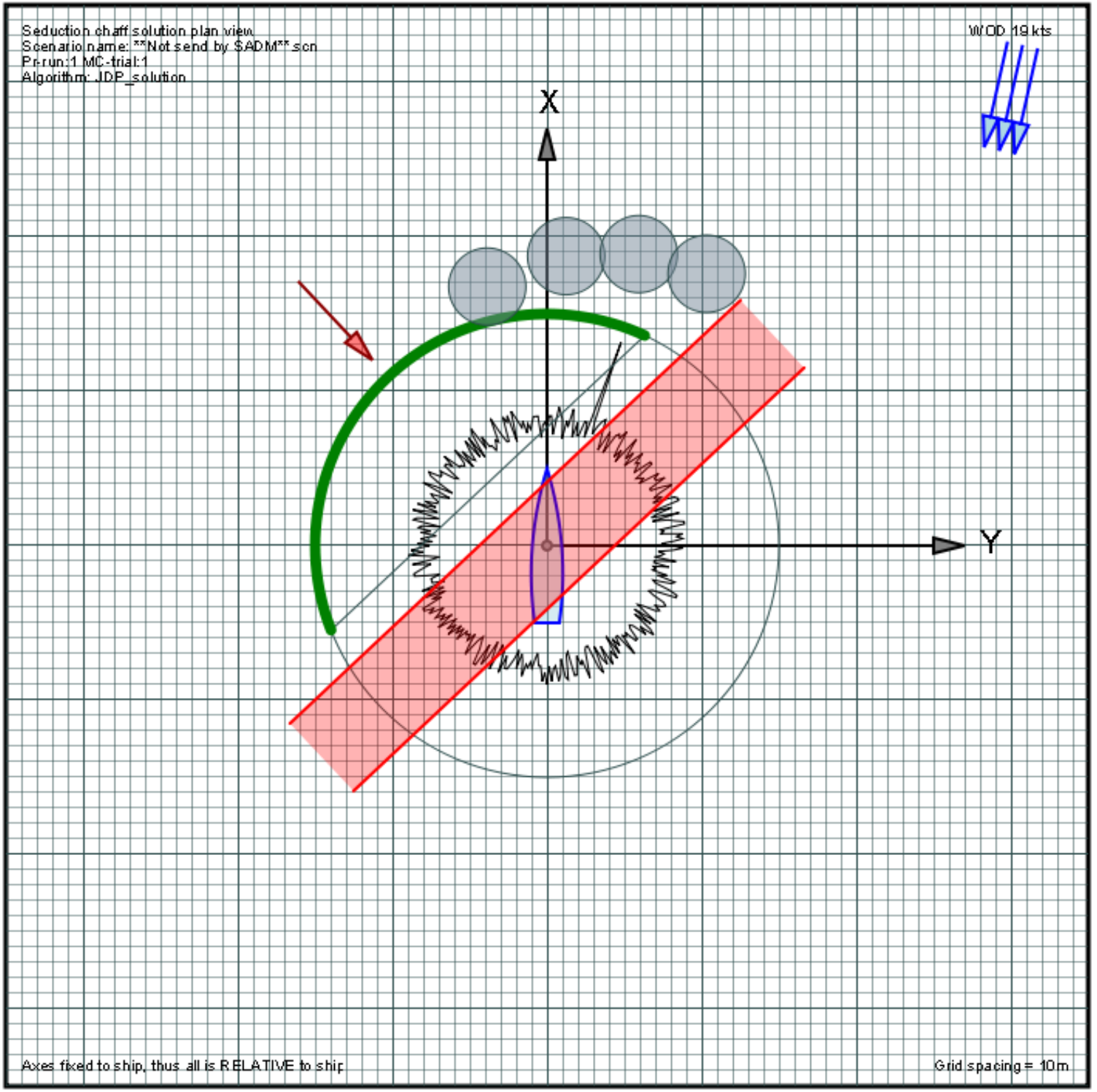
- A round fired some distance from a ship releasing fine pieces of foil to reflect radar waves.
- Seduction chaff is used to defend against an incoming missile threat already locked onto own ship.
- Chaff aims to present a more valid target than the ship itself.


SIMDIS [seduction.fct] c:\crow\extra
File
Time
View
Eye
Data Manager
Media
Overlays
Tools
Display
Map
Plug-in Tools
Help
DC
TS
TC
Time: 001 00:00:10.488
Time Step: 0.100 Secs
Distance: 500.000 m
Azim: 3.209°
Elev: 14.771°
Centered: Blue (S1) Chaff 1 [generic]
Ready.
20:18:00
N/A
N/A
N/A


Power in Red ASM 1 Seeker Track Gate for Blue Ship 1
Peak Power in Track Gate
Blue Ship 1 Power in Track Gate
Blue Ship 1 Chaff 1 Power in Track Gate
Threat turn-on time
Power (dBW)
-20
-30
-40
-50
-60
-70
-80
-90
-100
-110
-120
-130
0
5
10
15
20
25
Time (s)

What is an ECM “Drill”

- Part of an EW system controlling chaff is a component responsible for calculating an optimised chaff deployment solution.
- On our frigates this component is called the “drill calculator”
- In a threat situation, this calculator is used to find a solution based on the current scenario.
- Main input variables are
  - Ship velocity
  - Threat bearing
  - Wind velocity


Seduction chaff solution plan view
Scenario name: **Not send by SADM** scn
Pr-run:1 MC-trial:1
Algorithm: JDP_solution
WOD 19 kts
X
Y
Axes fixed to ship, thus all is RELATIVE to ship
Grid spacing = 10 m

Entities and systems involved

- Threat missile
  - Radar seeker
- Environment
  - Wind
- Defending ship
  - Signature
  - Sensors (ESM and / or radar)
  - Chaff solution calculator
  - Chaff launcher
  - Chaff rockets

Ship Air Defence Model (SADM)

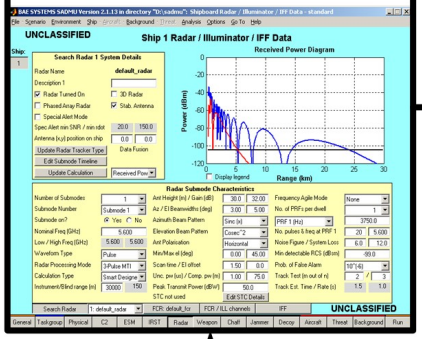
- Simulation tool from BAE Systems Australia
- Simulates a ship defending against threat missiles using its sensors and effectors managed by a Command and Control(C2) system
- Flexible and extendible through external interfaces
- Detail models of:
  - Most warship systems
  - Electro magnetic environment
  - Radar anti-ship missiles

Configure

Simulate

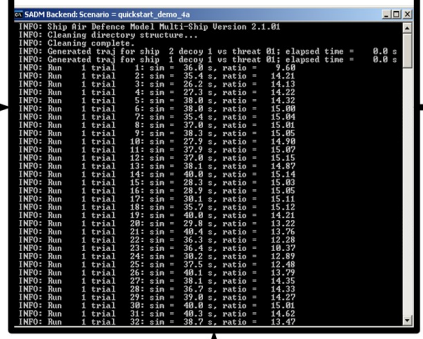
Analyze

Scenario Configuration



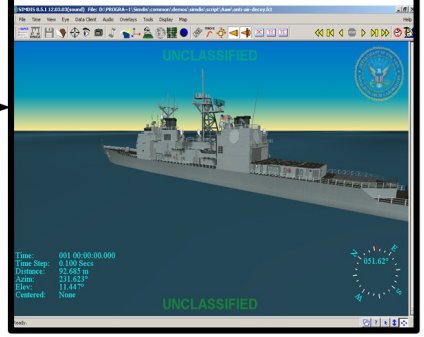
INPUT DATA FILE

Simulation Core



OUTPUT DATA FILE

Visual Analysis



Configured Libraries

default_fcr.fcr

default_radar.rdr

generic_radar.rdr

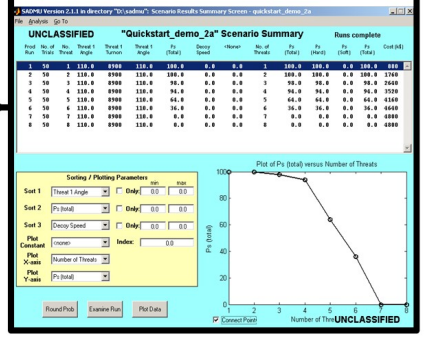
PA Horiz.rdr

Corvette Models

Environment Models

Threat Models

Detail Data Analysis



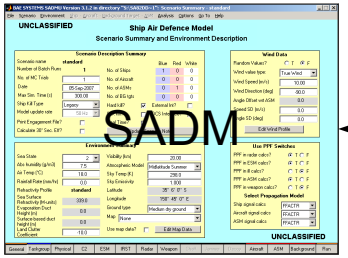
IMT's external C2 module

- Module configured by IMT to represent unique characteristics of a ship Command and Control system.
- TCP/IP based so it can run on a separate computer.
- The user has some freedom to select which ship systems are controlled by the External C2. The rest are all under control of the SADM C2.

IMT's external C2 module (2)

- The external C2 mainly caters for seduction chaff. May be expanded in future.
- Seduction chaff requires a detailed algorithm to calculate a solution which is not configurable with parameters alone.
- Seduction chaff algorithms implemented:
  - Actual Frigate chaff solution algorithm (Classified)
  - JP's experimental algorithm

External C2 environment



SADM

C2_extern
(IMT)

Soft-kill
(Classified)

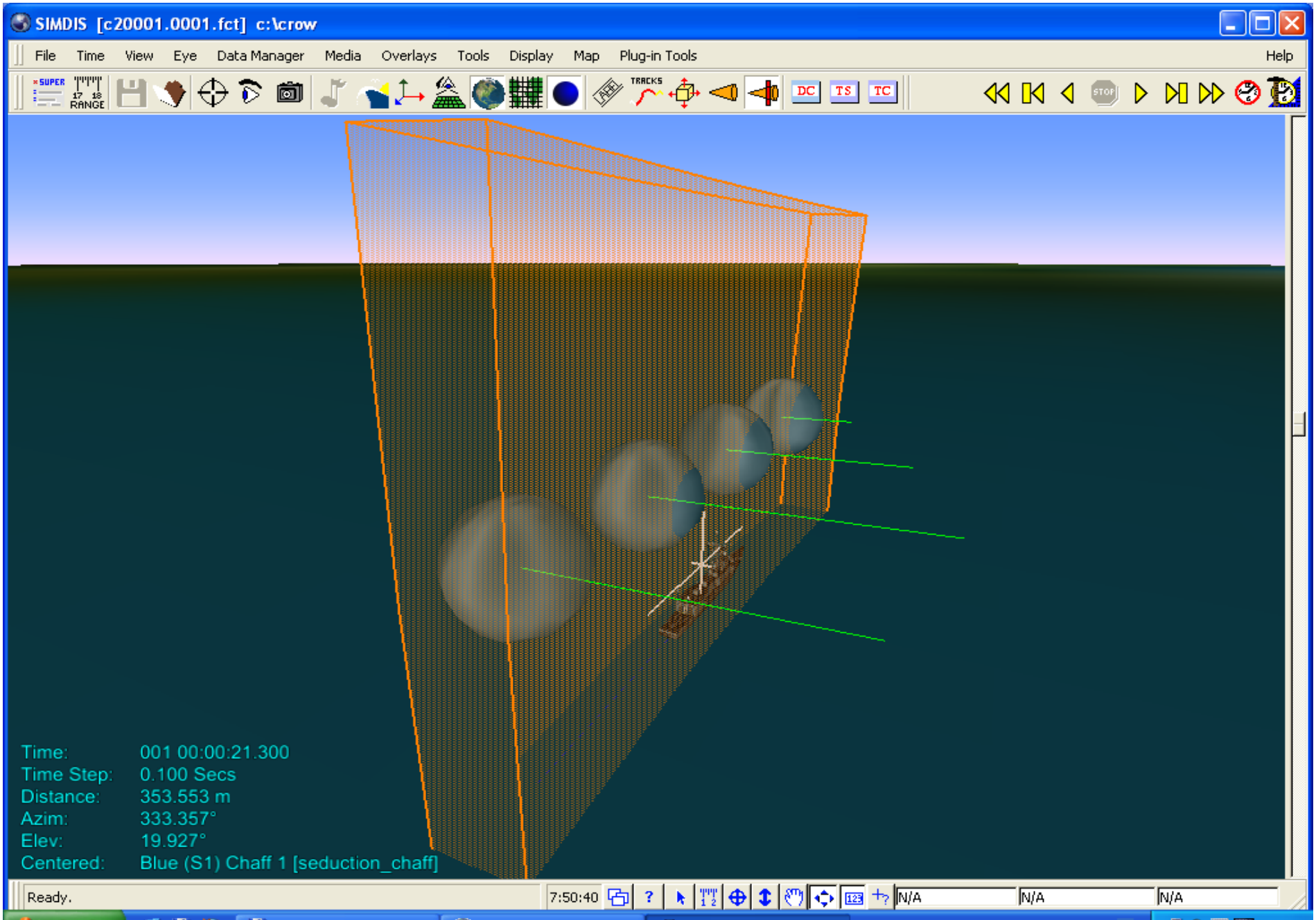
TEWA
(Classified)

Link-ZA
(tracks)

Human
Behaviour
Model

TCP/IP
Connection

Simulation results



Future of chaff

- Recent developments is ensuring that chaff is still relevant against modern missile seekers
- The use of chaff rounds combining RCS and IR signatures is now a reality.
- Variable fuse times make detail chaff solutions viable.
- Using tens of smaller rounds make signatures much more realistic.

Questions?